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FORM NO 1310

PAGE 1

NTS TEST REPORT

HUNS 95-428, 429, 430, 431-SP-61

SPECIAL TEST &

CONVAIR-SAMCO, Inc., Ca. 90045
ASTP-ATTN: SMSD

SEP 4 1959

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PREPARED BY

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AND

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REPORT NO. 1310

PAGE 11

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UNCLASSIFIEDTABLE OF CONTENTS

	<u>Page</u>	<u>No. of Pages</u>
Security Notice	11	1
Table of Contents	111	1
Section 1: Summary	1	1
Section 2: Engine LO2 Tank Fill	2	1
Section 3: Overall Systems Performance	3	4
Section 4: Data	7	22
Section 5: Instrumentation Survey	29	3
Section 6: Test Preparations	32	6
Appendix 1: Figures	38	7
Appendix 2: Operating Conditions	45	3
Appendix 3: Test Article History	48	5
Appendix 4: Distribution	53	2
Total Pages		57

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UNCLASSIFIEDSECTION 1Summary

Runs 428 through 431-SPh-S1 were special tests performed at MSTC Test Stand 1-95. The primary objective of Run 428 and 429 was to test the new fill provisions for the engine LO2 tank. Runs 430 and 431 had three objectives. They were: (a) to determine the effectiveness of the reworked fill ducting for the engine LO2 tank, (b) to further evaluate the LO2 Recirculator In (breakaway valve) temperature problem, and (c) to determine the adequacy of chilldown for the vernier engine LO2 ducting.

The engine LO2 tank fill times were well within the required 13 minutes for all four runs.

On Run 430, with LO2 ducting insulated, the maximum LO2 Recirculator In (breakaway valve) temperature reached during the warm interval after LO2 LOADING COMPLETE was -289 DGF at 13.2 minutes. On Run 431, with this insulation removed, the corresponding temperature was warmer than -287 DGF (upscale of recorder limit). The LO2 topping valve was full open (28 GPM) for both runs (430 and 431) during the 15 minute LO2 topping hold.

During both runs (430 and 431) visual observations verified that satisfactory Vernier Engine LO2 ducting chilldown was achieved.

During Run 428 the missile LO2 tank pressure exceeded redline (10 psig). The maximum pressure reached was 10.7 psig when emergency pressurization was initiated. After drain, inspection revealed valve L-26 closed. This valve is located in the sense line from the LO2 storage tank ullage to the tee of the pressure controller and instrumentation transducers. No damage resulted as a result of the incident.

Fuel and LO2 were satisfactorily loaded at IOC flow rates with the Acoustica Propellant Loading Control System properly controlling the loading sequences during Run 428 and 431. Run 428 was terminated manually at 8.70 minutes after Fuel Load Start because the objective of the test had been accomplished. During Run 430 the Acoustica LO2 90% level probe activated prematurely.

HE/LN2 loading was not included in the plan for these runs.

Missile tank pressures were maintained within the prescribed limits in all sequences during Runs 429, 430 and 431, as well as during Run 428 after the L-26 hand valve problem was eliminated (see LO2 Loading System discussion, Page 3).

The LO2 boiloff valve P/N 27-80588-811 operated satisfactorily during all four runs.

No missile or facility damage occurred during these runs.

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REPORT EM 1310

PAGE 2

SECTION 2

Engine LO2 Tank Fill and Vernier Chillover

Based on data accumulated during regular Phase III testing and in special tests following the conclusion of Block II, the engine LO2 plumbing configuration was changed to improve the Engine LO2 Tank fill time. The revised design is described in the Configuration portion of Appendix III, Test Article History, and is shown in the schematics of Figures 1 and 2. As shown in the fill time table below, the Engine LO2 Tank filled satisfactorily on all four runs.

Analysis of Engine LO2 tank pressure records and EA data from P1673X VERNIER LO2 TANK FULL (Engine LO2 Tank Full) during previous testing led to the conclusion that the fill time could be determined from the pressure records as clearly as from the sequence data. The LO2 detector probe for P1673X was removed from the system and fill times here were determined by pressure data analysis.

<u>Run No.</u>	<u>Fill Time</u> (Minutes after FUEL LOAD START)
428	7.7
429	7.6
430	8.2
431	8.2

Visual observation of vernier LO2 bleed verified that Vernier Engine LO2 plumbing chilled down in approximately 10.5 minutes after FUEL LOAD START.

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CONVAIR ASTRONAUTICS

REPORT RM 1310

PAGE 3

SECTION 3

Overall Systems Performance

FUEL LOADING SYSTEM

Fuel Loading System operation for Runs 428, 429, 430 and 431 was satisfactory, with loading being terminated by the Acoustica 100% fuel level probe. The following data summarizes the Fuel Loading System for all four runs.

Fuel Loading Data

<u>Run No.</u>	<u>Termination Time</u> <u>(Minutes after fuel load start)</u>	<u>Total Weight</u> <u>(Pounds)</u>	<u>Maximum Flow Rate</u> <u>(GPM)</u>
428	6.44	77,250	4600
429	6.35	77,250	4600
430	6.71	77,150	4600
431	6.40	77,090	4600

LO2 LOADING SYSTEM

LO2 Loading System operation was satisfactory during Runs 428 and 429. However, prior to recycling the count during Run 428 the missile LO2 tank pressure exceeded the red line (10 psig) due to valve L-26 being closed. This valve is located in the sense line from the LO2 storage tank ullage to the tee of the pressure controller and instrumentation transducer. This prevented pressure sensing of the LO2 storage tank ullage to the pressure controller, the LO2 console and the instrumentation recorder.

Since no ullage pressure was sensed by the pressure controller, the LO2 storage tank was pressurized above normal (normal pressure during cooldown is 15 to 30 psig). This caused an excessive LO2 flow rate into the missile. The boiloff valve could not relieve the excess pressure caused by the boiling liquid; consequently, the ullage pressure in the missile LO2 tank rose above red line. Emergency pressurization was initiated and manual detanking was performed with no further incident. See Missile Pressurization System discussion for further details resulting from this problem.

After recycling the count for Run 428, and allowing time for the propulsion LO2 system to return to ambient temperature, the weight of LO2 loaded was 173,490 pounds with loading being terminated by the Acoustica 90% LO2 level probe at 11.59 minutes. LO2 loading was terminated manually during Run 429 at 8.67 minutes with 102,360 pounds of LO2 aboard (58.5% LO2 level).

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 4

The L02 Loading System operation was satisfactory during Run 430 and 431. However, during Run 430 the Acoustica 90% L02 level probe prematurely signalled L02 rapid load valve close at the 66.9% L02 level. The L02 console operator initiated L02 rapid load valve open 0.22 minutes later and closed it when the L02 tank head pressure (U1901V) read 89.0% L02 level. L02 loading was terminated automatically by the 99% L02 level probe during Runs 430 and 431 at 11.81 and 11.57 minutes respectively. The weight of L02 loaded was 172,080 pounds with a maximum L02 flow rate of 5750 GPM for both runs.

The performance of the L02 Topping System was satisfactory with the L02 topping valve full open throughout both Runs 428 and 429. The maximum flow rate with the L02 topping valve full open is 28 GPM.

The L02 Recirculator In temperature (P1925T) remained below -291 DGF for Run 428 during L02 loading and increased to -282.5 DGF during the 1.17 minute L02 topping hold. The maximum temperature reached was -281 DGF before drain start. This temperature (P1925T) remained colder than -291 DGF for Run 429 during loading. There was no topping hold as L02 loading was terminated at the 58.5% L02 level. See Figure 5 for details of L02 Recirculator In temperature (P1925T) during Run 428.

The L02 Topping System operation was satisfactory during Run 430 and 431 with the L02 topping valve full open throughout both runs (28 GPM maximum flow). The airborne fill and drain valve and the L02 manifold, including the portion of the manifold inside the thrust barrel up to the pump inlets, were insulated prior to Run 430. The L02 Recirculator In temperature (P1925T) for Run 430 remained below -291 DGF throughout L02 loading and the 15 minute L02 topping except between 12.1 and 13.5 minutes. The maximum temperature reached was -289 DGF.

The portion of insulation inside the thrust barrel up to the pump inlets was removed prior to Run 431. The L02 Recirculator In temperature (P1925T) for Run 431 remained below -291 DGF throughout L02 loading and the 15 minute L02 topping hold except between 10.1 and 14.0 minutes. The maximum temperature reached cannot be determined because the temperature exceeded the upper recorder limit of -287 DGF. See Figure 6 for details of the L02 Recirculator In temperature (P1925T) during Runs 430 and 431.

GO2 sampling was not used for Runs 428, 429, 430 and 431.

HELIUM/LN2 LOADING SYSTEM

Helium/LN2 loading was not planned for Runs 428, 429, 430 and 431.

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 5

CONVAIR PROPELLANT LOADING CONTROL SYSTEM

The Convair Propellant Utilization System was monitored during all four runs. The propellant loading control unit was removed prior to Run 417 and returned to San Diego.

The following table summarizes data obtained from the error demodulator output signal during the LO2 loading cycle of Runs 428, 430 and 431. Run 429 was terminated before the LO2 loading cycle was complete, therefore no data were obtained for the 90% and 99% LO2 levels.

All values are PU-sensed percent of nominal (2.25 LO2/fuel) mass ratio and are referenced to the time of the indicated Acoustica probe signal.

Run No.	Percent of Nominal Mass Ratio	
	Sensed at time of	Sensed at time of
	Acoustica LO2	Acoustica LO2
	90% probe	99% probe
428	88.7	102.6
430	*	103.2
431	91.6	102.3

*Premature signal. The PU system error trace is invalid at this time.

ACOUSTICA PROPELLANT LOADING CONTROL SYSTEM

The performance of the Acoustica Propellant Loading Control System was satisfactory for all runs except Run 430. On this run, the LO2 90% probe signalled LO2 RAPID LOAD STOP when the missile was only 66.9% full. The performance of the Acoustica PLCS during the fuel loading cycle of Run 430 was satisfactory. The LO2 overfill topping probe signalled during changeover to flight pressurization during Runs 430 and 431. However, this did not affect the performance of the system as all loading was complete.

These erroneous signals are due to the sensitivity setting of the control units, the values of which were determined and set for maximum sensitivity under Sequence II-L pressure to assure a positive cutoff signal.

MISSILE PRESSURIZATION SYSTEM

The Missile Pressurization System operated satisfactorily during Runs 428 and 429. However, during Run 428, prior to recycling the countdown, the missile LO2 tank pressure (F1001P) exceeded the red line (10 psig) due to a LO2 Loading System problem. See LO2 Loading System discussion for details of the problem. The maximum missile LO2 tank pressure reached was 10.7 PSIG when emergency pressurization was initiated. The missile fuel tank pressure

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REPORT FM 1310

PAGE 6

(F1003P) was 28 PSIG and missile LO2 tank head pressure (U1901P) was 2.6 PSIG at this time. The minimum bulkhead differential pressure was 14.7 PSID. See Figure 7.

After the countdown was resumed for Run 428 the minimum and maximum missile LO2 tank pressure (F1001P) was satisfactory. The minimum and maximum missile LO2 tank pressures (F1001P) for Runs 429, 430 and 431 were satisfactory.

The boiloff valve performed satisfactorily, maintaining the desired missile LO2 tank pressure during all runs, except during the first attempt at Run 428, when rapid loading of LO2 into "hot" plumbing created more G02 than the valve could handle.

The fuel tank pressure was normal throughout all four runs.

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REPORT EM 1310

PAGE 13

1-95 431 TIME SLICE DATA

MEAS #	DESCRIPTION	UNIT REC	5	3	5	8	11	15
F1001P	LO2 TANK HELIUM	PSIG L/N	2.2	2.8	2.7	2.7	2.7	2.5
F1003P	FUEL TANK HELIUM	PSIG L/N	9.3	28.7	27.2	58.0	58.0	58.0
F1066P	GO2 BO LN @ ELBOW	PSIG L/N	2.0	1.6	2.1	2.3	2.5	2.3
F1952P	LO2 STOR TK PR	PSIG BRN	0	18	18	105	105	105
F1953P	FUEL STORAGE TK PR	PSIG BRN	9	111	116	120	120	120
F1004T	FUEL TANK HE	DGF BRN	72	104	71	74	74	71
F1064T	GO2 BO @ ELBOW	DGF BRN	72	-45	-205	-153	-100	-100
F1739T	FUEL PRESS GAS	DGF BRN	66	41	31	36	40	40
F1744T	HE-LN2 HT EXCH OUT	DGF BRN	73	73	73	73	73	73
F1805T	PRESS GAS MAN	DGF BRN	70	69	68	55	40	35
N1980T	TEMP TO SAMPLE BTL	DGF BRN	28	28	28	23	27	27
N1983T	FULL FUEL PRESS BTL	DGF BRN	72	70	68	60	60	60
P1001P	B1 LO2 PUMP IN	PSIG L/N	2.0	2.0	7.0	21.5	21.5	21.5
P1030P	ENG LO2 TK PRESS	PSIG BRN	3.6	10.4	7.4	12.3	12.3	12.3
P1672P	VERN FUL TK DIF	PID BRN	0	2.0	1.0	2.0	2.0	2.0
P1682P	PRESS DIF ON LO2 TK	PID BRN	0	0	0	0	0	0
P1762P	ENG LO2 TK VENT	PSIG BRN	0	2.0	1.0	2.0	2.0	2.0
P1814P	LO2 TPG VLV	PID BRN	-6.8	2.0	5.0	11.0	11.0	11.0
P1816P	LO2 SUBCOOLER	PID BRN	-0.5	-0.5	4.2	3.0	3.0	3.0
P1900P	LAUNCHER INLET LO2	PSIG BRN	0	0	3	14	14	14
P1908P	PR DIFF FUEL TK	PID BRN	-0.1	0	0.7	1.0	1.0	1.0
P1950P	LAUNCHER INLET FUEL	PSIG L/N	9	81	41	14	14	14
P1763R	ENG LO2 TK VENT FLOW	GPM L/N	0	2	3	25	25	25
P1020T	B1 LO2 PUMP IN	DGF BRN	10	10	10	10	10	10
P1054T	B2 LO2 PUMP IN	DGF BRN	78	-290	-293	-296	-296	-296
P1530T	SUS LO2 PUMP IN	DGF BRN	78	-293	-292	-282	-282	-282
P1700T	FUL STK DISCH	DGF BRN	72	76	76	76	76	76
P1862T	LO2 SUBCOOLER OUT	DGF BRN	-110	-245	-274	-291	-291	-291
P1869T	LO2 TPG DISCH	DGF BRN	45	-143	-255	-280	-280	-280
P1887T	ENG COMP AMB BYCONE	DGF BRN	107	108	105	107	107	107
P1888T	VERN CTL MAN ENV	DGF BRN	94	94	94	92	92	92
P1889T	VERN CTL MAN METAL	DGF BRN	94	94	94	92	92	92
P1903T	LAUNCHER LO2 IN	DGF BRN	78	-232	-252	-257	-257	-257
P1904T	B2 LO2 PUMP VOL EXT	DGF BRN	90	83	73	70	70	70
P1905T	B1 LO2 PUMP VOL INT	DGF BRN	78	-288	-288	-277	-277	-277
P1907T	B1 LO2 PUMP VOL EXT	DGF BRN	97	95	90	80	80	80
P1912T	LAUNCHER LO2 OUT	DGF BRN	1H	1H	1H	1H	1H	1H
P1925T	LO2 RECIRC IN	DGF BRN	78	-294	-297	-297	75	-200
U1901P	LO2 TK HEAD	%FUL BRN	0	3	10	31	94	99
U1902P	FUL TK HEAD	%FUL BRN	5	53	94	100	100	100
U1091V	ERROR RAT DMOD OTP	VDC BRN					-0.5	2.2

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CONVAIR ASTRONAUTICS

REPORT 34 1310

PAGE 8

1-95 428 TIME SLICE DATA

MEAS #	DESCRIPTION	UNIT REC	TIME	IN	MIN		
			0	3	5	8	11
F1001P	LO2 TANK HELIUM	PSIG L/N	2.3	3.0	2.8	2.8	2.5
F1003P	FUEL TANK HELIUM	PSIG L/N	10	28.2	26.6	56.5	56.5
F1066P	GO2 BO LN @ ELBOW	PSIG L/N	2.4	2.0	2.5	2.7	2.6
F1952P	LO2 STOR TK PR	PSIG BRN	0	21	21	107	108
F1953P	FUEL STORAGE TK PR	PSIG BRN	6	107	111	113	113
F1004T	FUEL TANK HE	DGF BRN	122	128	76	76	76
F1739T	FUEL PRESS GAS	DGF BRN	72	41	21	28	32
F1744T	HE-LN2 HT EXCH OUT	DGF BRN	78	77	78	80	80
F1805T	PRESS GAS MAN	DGF BRN	76	76	75	65	55
N1980T	TEMP TO SAMPLE BTL	DGF BRN	2A	2A	2A	2A	2A
N1983T	FULL FUEL PRESS BTL	DGF BRN	76	16	72	70	44
P1001P	B1 LO2 PUMP IN	PSIG L/N	1.5	6	6.2	21.2	28.3
P1030P	ENG LO2 TK PRESS	PSIG BRN	5.0	9.6	6.7	23.4	23.1
P1672P	VERN FUL TK DIF	PID BRN	0	2.5	1.5	15	15.9
P1682P	PRESS DIF CN LO2 TK	PID BRN	2A	2A	0	0	.05
P1762P	ENGINE LO2 TK VENT	PSIG BRN	0	2.6	1.5	16.4	16.0
P1814P	LO2 TPG VLV	PID BRN	-6.8	5.1	6.3	12.3	21.5
P1816P	LO2 SUBCOOLER	PID BRN	5.4	2.4	5.1	78	78
P1900P	LAUNCHER INLET LO2	PSIG BRN	4	13	14	63	36
P1908P	OR DIF FUEL TK	PID BRN	0	0	.73	1.2	1.2
P1950P	LAUNCHER INLET FUEL	PSIG L/N	9	81	41	36	41
P1245R	T SYS FUEL FR	GPM L/N	0	3990	410	0	0
P1763R	ENG LO2 TK VENT FLOW	GPM L/N	2.2	2.2	78	78	75
P1020T	B1 LO2 PUMP IN	DGF BRN	78	-293	-292	-294	-290
P1054T	B2 LO2 PUMP IN	DGF BRN	78	-289	-292	-297	-297
P1530T	SUS LO2 PUMP IN	DGF BRN	78	-293	-292	-281	-276
P1700T	FUL STK DISCH	DGF BRN	76	78	78	77	75
P1862T	LO2 SUBCOOLER OUT	DGF BRN	-65	-109	-263	-277	-285
P1869T	LO2 TPG DISCH	DGF BRN	37	-90	-211	-245	-255
P1887T	ENG COMP AMB BYCONE	DGF BRN	1D	1D	1D	1D	1D
P1888T	VERN CTL MAN ENV	DGF BRN	112	112	112	112	110
P1889T	VERN CTL MAN METAL	DGF BRN	111	112	112	110	110
P1903T	LAUNCHER LO2 IN	DGF BRN	1F	1F	1F	1F	1F
P1904T	B2 LO2 PUMP VOL EXT	DGF BRN	1D	1D	1D	1D	1D
P1905T	B1 LO2 PUMP VOL INT	DGF BRN	78	-290	-289	78	75
P1906T	B2 LO2 PUMP VOL INT	DGF BRN	1A	1A	1A	1A	1A
P1907T	B1 LO2 PUMP VOL EXT	DGF BRN	105	105	100	98	95
P1912T	LAUNCHER LO2 OUT	DGF BRN	1H	1H	1H	1H	1H
P1925T	LO2 RECIRC IN	DGF BRN	78	-292	-290	-296	-292
U1901P	LO2 TK HEAD	%FUL BRN	0	4	8	31	96

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REPORT EM 1310

PAGE 9

1-95 428 TIME SLICE DATA

MEAS #	DESCRIPTION	UNIT REC	0	TIME 3	IN 5	MIN 8	1.
U1902P	FUL TK HEAD	%FUL BRN	7	51	91	100	100
U1091V	ERROR RAT DMOD OTP	VDC BRN					-..

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 10

1-95 429 TIME SLICE DATA

MEAS #	DESCRIPTION	UNIT REC	0	3	5	8
F1001P	LO2 TANK HELIUM	PSIG L/N	2.0	2.7	2.7	2.7
F1003P	FUEL TANK HELIUM	PSIG L/N	10.1	28.2	26.9	57
F1066P	GO2 BO LN @ ELBOW	PSIG L/N	2.5	2.0	2.6	2.8
F1952P	LO2 STOR TK FR	PSIG BRN	0	21	21	100
F1953P	FUEL STORAGE TK PR	PSIG BRN	6	106	111	100
F1004T	FUEL TANK HE	DGF BRN	112	128	77	77
F1064T	GO2 BO @ ELBOW	DGF BRN	106	124	-195	-177
F1739T	FUEL PRESS GAS	DGF BRN	73	43	23	21
F1744T	HE-LN2 HT EXCH OUT	DGF BRN	83	83	83	81
F1805T	PRESS GAS MAN	DGF BRN	73	73	72	60
N1980T	TEMP TO SAMPLE PTL	DGF BRN	-96	-96	-88	-81
N1983T	FULL FUEL PRESS BTL	DGF BRN	77	77	77	77
P1001P	B1 LO2 PUMP IN	PSIG L/N	1.0	5.0	6.2	21.2
P1030P	ENG LO2 TK PRESS	PSIG BRN	4.0	7.5	0.7	22.5
P1682P	PRESS DIF ON LO2 TK	PID BRN	0	0	.02	.7
P1762P	ENG LO2 TK VENT	PSIG BRN	0	0	1.0	9.0
P1814P	LO2 TPG VLV	PID BRN	-7	5.2	6.3	12.1
P1816P	LO2 SUBCOOLER	PID BRN	4.4	4.2	4.6	7.0
P1900P	LAUNCHER INLET LO2	PSIG BRN	0	15	14	0
P1908P	PR DIF FUEL TK	PID BRN	0	0	.02	2.10
P1950P	LAUNCHER INLET FUEL	PSIG L/N	0	30	40	0
P1245R	T SYS FUEL FR	GPM L/N	0	1050	400	0
P1763R	ENG LO2 TK VENT FLOW	GPM L/N	2	5	63	0
P1020T	B1 LO2 PUMP IN	DGF BRN	70	-204	-200	-
P1054T	B2 LO2 PUMP IN	DGF BRN	70	-290	-200	-
P1530T	SUS LO2 PUMP IN	DGF BRN	73	-294	-190	-
P1700T	FUL STK DISCH	DGF BRN	80	70	70	-
P1862T	LO2 SUBCOOLER OUT	DGF BRN	-63	-243	-263	-
P1869T	LO2 TPG DISCH	DGF BRN	30	-94	-245	-20
P1887T	ENG COMP AMP BYCONE	DGF BRN	10	10	10	1
P1888T	VERN CTL MAN ENV	DGF BRN	100	100	110	1
P1889T	VERN CTL MAN METAL	DGF BRN	100	100	110	1
P1903T	LAUNCHER LO2 IN	DGF BRN	10	10	11	1
P1904T	B2 LO2 PUMP VOL EXT	DGF BRN	10	10	10	1
P1905T	B1 LO2 PUMP VOL INT	DGF BRN	70	-190	-190	-
P1906T	B2 LO2 PUMP VOL INT	DGF BRN	10	10	10	1
P1907T	B1 LO2 PUMP VOL EXT	DGF BRN	10	10	10	1
P1912T	LAUNCHER LO2 OUT	DGF BRN	58	-195	-234	-256
P1925T	LO2 RECIRC IN	DGF BRN	70	-292	-290	-296

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CONVAIR  ASTRONAUTICS

REPORT EM 1310

PAGE 11

1-95 429 TIME SLICE DATA

MEAS #	DESCRIPTION	UNIT REC	TIME	IN	MI.
			0	3	5 8
U1901P	L02 TK HEAD	%FUL BPN	0	2	7 5
U1902P	FUL TK HEAD	%FUL BPN	0	53	94 59

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REPORT EM 1310

CONVAIR ASTRONAUTICS

PAGE 12

1-95 430 TIME SLICE DATA

MEAS #	DESCRIPTION	UNIT REC	TIME		IN		MIN		11	15
			0	3	5	8				
F1001P	LO2 TANK HELIUM	PSIG L/N	2.4	2.7	2.9	2.8			2.4	2.0
F1003P	FUEL TANK HELIUM	PSIG L/N	2.8	28.2	27.8	27.2			27.0	27.0
F1066P	GO2 BO LN @ FLOW	PSIG L/N	2.0	1.9	2.0	2.2			2.1	2.4
F1952P	LO2 STOP TK PR	PSIG RPN	0	20	20	105			105	106
F1953P	FUEL STORAGE TK PR	PSIG RPN	9	111	112	110			110	120
F1004T	FUEL TANK HE	DGF RPN	60	91	72	72			72	72
F1064T	GO2 BO @ ELBOW	DGF RPN	70	-110	-217	-190			-195	-260
F1739T	FUEL PRESS GAS	DGF RPN	62	46	45	22			40	42
F1744T	HE-LN2 HT EXCH OUT	DGF RPN	62	62	69	60			60	60
F1805T	PRESS GAS MAN	DGF RPN	72	72	72	67			66	66
N1980T	TEMP TO SAMPLE RTL	DGF RPN	26	26	26	20			20	21
N1983T	FULL FUEL PRESS RTL	DGF RPN	62	67	67	66			66	66
P1001P	R1 LO2 PUMP IN	PSIG L/N	2.4	5.1	5.0	21.2			20.2	21.1
P1030P	ENG LO2 TK PRESS	PSIG RPN	1.5	11.2	8.6	11.0			21.0	25.0
P1672P	VERN FUL TK DIF	PID RPN	0	2.3	1.5	1.0			10.7	15.2
P1682P	PRESS DIF ON LO2 TK	PID RPN	0	0	0	0			0.03	1.60
P1762P	ENG LO2 TK VENT	PSIG RPN	0	2.2	1.5	2.2			13.2	25.5
P1816P	LO2 SURCOOLER	PID RPN	-0.30	2.2	4.0	12.0			10.0	10.0
P1900P	LAUNCHER INLET LO2	PSIG RPN	0	21	15	65			67	7
P1908P	PR DIF FUEL TK	PID RPN	0	0	.60	1.17			1.17	1.17
P1950P	LAUNCHER INLET FUEL	PSIG L/N	2	21	41	12			13	15
P1763R	ENG LO2 TK VENT FLOW	GPM L/N	0	1	0	23			0	7
P1020T	R1 LO2 PUMP IN	DGF RPN	70	-293	-292	-292			-290	-294
P1054T	R2 LO2 PUMP IN	DGF RPN	78	-290	-291	-297			-297	-290
P1530T	SUS LO2 PUMP IN	DGF RPN	70	-294	-291	-291			-270	-281
P1700T	FUL STY DISCH	DGF RPN	66	77	70	70			77	77
P1862T	LO2 SURCOOLER OUT	DGF RPN	36	-290	-276	-290			-287	-297
P1369T	LO2 TRG DISCH	DGF RPN	60	-100	-250	-277			-290	-294
P1387T	ENG COMP AIR CYCONE	DGF RPN	62	67	64	65			61	64
P1808T	VERN CTL MAN ENV	DGF RPN	54	55	55	50			57	50
P1389T	VERN CTL MAN METAL	DGF RPN	52	56	53	50			50	50
P1903T	LAUNCHER LO2 IN	DGF RPN	70	-224	-260	-275			-290	-290
P1904T	R2 LO2 PUMP VOL EXT	DGF RPN	62	62	57	54			52	40
P1905T	R1 LO2 PUMP VOL INT	DGF RPN	70	-264	-261	-240			-212	-214
P1907T	R1 LO2 PUMP VOL EXT	DGF RPN	50	62	57	56			50	40
P1912T	LAUNCHER LO2 OUT	DGF RPN	10	10	10	10			10	10
P1925T	LO2 RECIRC IN	DGF RPN	70	-223	-292	-290			-285	-290
U1901P	LO2 TK HEAD	SEUL RPN	0	2	7	21			00	00
U1902P	FUL TK HEAD	SEUL RPN	2	46	20	100			100	100
U1091V	ERROR RAT D'OOD OTP	VOC RPN							-1.0	0.1

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CONVAIR ASTRONAUTICS

REPORT FM 1310

PAGE 13

1-95 431 TIME SLICE DATA

MEAS #	DESCRIPTION	UNIT REC	5	3	5	8	11	15
F1001P	LO2 TANK HELIUM	PSIG L/N	2.2	2.8	2.7	2.7	2.7	2.5
F1003P	FUEL TANK HELIUM	PSIG L/N	9.3	28.7	27.2	58.0	58.0	58.0
F1066P	GO2 BO LN @ ELBOW	PSIG L/N	2.0	1.6	2.1	2.3	2.5	2.2
F1952P	LO2 STOR TK PR	PSIG BRN	0	18	18	105	105	105
F1953P	FUEL STORAGE TK PR	PSIG BRN	9	111	116	120	120	120
F1004T	FUEL TANK HE	DGF BRN	72	104	75	74	74	74
F1064T	GO2 BO @ ELBOW	DGF BRN	72	-45	-205	-153	-77	-77
F1739T	FUEL PRESS GAS	DGF BRN	66	41	31	36	40	42
F1744T	HE-LN2 HT EXCH OUT	DGF BRN	73	73	73	73	73	73
F1805T	PRESS GAS MAN	DGF BRN	70	69	68	55	43	45
N1980T	TEMP TO SAMPLE BTL	DGF BRN	28	28	28	23	27	27
N1983T	FULL FUEL PRESS BTL	DGF BRN	72	70	68	60	50	50
P1001P	B1 LO2 PUMP IN	PSIG L/N	2.0	2.0	7.0	21.5	21.5	21.5
P1030P	ENG LO2 TK PRESS	PSIG BRN	3.6	10.4	7.4	12.3	12.3	12.3
P1672P	VERN FUL TK DIF	PID BRN	0	2.0	1.0	2.0	12.0	12.0
P1682P	PRESS DIF ON LO2 TK	PID BRN	0	0	0	0	0	0
P1762P	ENG LO2 TK VENT	PSIG BRN	0	2.0	1.0	2.9	17.0	17.0
P1814P	LO2 TPG VLV	PID BRN	-6.8	2.0	5.0	11.0	22.0	22.0
P1816P	LO2 SUBCOOLER	PID BRN	-0.5	-0.5	4.2	3.2	1.0	7.0
P1900P	LAUNCHER INLET LO2	PSIG BRN	0	0	3	14	22	37
P1908P	PR DIF FUEL TK	PID BRN	-0.1	0	0.7	1.0	1.0	1.0
P1950P	LAUNCHER INLET FUEL	PSIG L/N	9	81	41	14	22	12
P1763R	ENG LO2 TK VENT FLOW	GPM L/N	0	2	3	25	25	25
P1020T	B1 LO2 PUMP IN	DGF BRN	10	10	10	10	22	10
P1054T	B2 LO2 PUMP IN	DGF BRN	78	-290	-293	-295	-295	-295
P1530T	SUS LO2 PUMP IN	DGF BRN	78	-293	-292	-282	78	78
P1700T	FUL STK DISCH	DGF BRN	72	76	76	76	76	76
P1862T	LO2 SUBCOOLER OUT	DGF BRN	-110	-245	-274	-291	-295	-295
P1869T	LO2 TPG DISCH	DGF BRN	45	-143	-255	-280	-295	-295
P1887T	ENG COMP AMB BYCONE	DGF BRN	107	108	105	102	78	78
P1888T	VERN CTL MAN ENV	DGF BRN	94	94	94	92	78	78
P1889T	VERN CTL MAN METAL	DGF BRN	94	94	94	92	78	78
P1903T	LAUNCHER LO2 IN	DGF BRN	78	-232	-252	-257	-295	-295
P1904T	B2 LO2 PUMP VOL EXT	DGF BRN	90	83	73	70	78	78
P1905T	B1 LO2 PUMP VOL INT	DGF BRN	78	-288	-288	-277	78	78
P1907T	B1 LO2 PUMP VOL EXT	DGF BRN	97	95	90	80	78	78
P1912T	LAUNCHER LO2 OUT	DGF BRN	1H	1H	1H	1H	1H	1H
P1925T	LO2 RECIRC IN	DGF BRN	78	-294	-297	-297	78	-299
U1901P	LO2 TK HEAD	%FUL BRN	0	3	10	31	94	99
U1902P	FUL TK HEAD	%FUL BRN	5	53	94	100	100	100
U1091V	ERROR RAT DMOD OTP	VDC BRN					-0.5	2.2

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CONVAIR ASTRONAUTICS

REPORT FM 1310

PAGE 14

1-95 428 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
0.00	8	N1912X	FUEL LOAD START SW	X	
0.00	2	N1901X	F PREPRES 1 VLV CLSD	X	
0.00	47	N1925X	LO2 COOLDOWN ST SW	X	
0.00	48	N1926X	LO2 TK VENT VLV CLSD		X
0.41	3	N1902X	F FINE LOAD VLV CLSD		X
0.41	11	P1966X	F MSL F/D VLV CLSD		X
0.41	15	N1919X	F STK PRESS CLSD		X
0.42	10	N1914X	F FINE LOAD VLV OPEN		X
0.42	13	N1917X	F GRD F/D VLV CLSD		X
0.44	14	N1918X	F GND F/D VLV OPEN		X
0.45	12	P1967X	F MSL F/D VLV OPEN		X
0.47	26	N1890X	INTER FUL STK PRESS	X	
0.63	19	N1943X	F LN LIQ DET/INTERM		X
0.82	17	N1922X	FUL RAPID LD SIGNAL		X
1.80	18	N1923X	FUL RAPID VLV CLSD		X
1.85	4	N1903X	FUL RAPID LD VLV OPN		X
2.09	52	N1932X	LO2 TOPPING VLV CLSD		X
2.09	64	N1968X	LO2 MSL F/D VLV CLSD		X
2.09	43	N1906X	LO2 FINE LD VLV CLSD	X	
2.10	50	N1930X	LO2 GND F/D VLV OPEN		X
2.11	49	N1929X	LO2 GND F/D VLV CLSD		X
2.11	53	N1933X	LO2 TOPPING VLV OPEN		X
2.12	16	N1921X	FUEL LOADING PRESS	X	
2.12	51	N1931X	LO2 FINE LD VLV OPEN		X
2.13	44	N1907X	LO2 STK P VLV A CLSD		X
2.13	54	N1934X	L RAPID LD VLV CLSD		X
2.13	63	N1967X	LO2 MSL F/D VLV OPEN		X
2.21	44	N1907X	LO2 STK P VLV A CLSD		X
2.23	44	N1907X	LO2 STK P VLV A CLSD		X
2.28	56	N1949X	LO2 LN LIQ DET/INTRM		X
2.30	66	N1891X	LO2 NOT IN UPPER LN		X
2.32	42	N1905X	L RAPID LD VLV OPEN		X
2.36	44	N1907X	LO2 STK P VLV A CLSD	X	
2.78	56	N1949X	LO2 LN LIQ DET/INTRM	X	
3.57	56	N1949X	LO2 LN LIQ DET/INTRM		X
4.06	27	N1969X	AA FUEL 90% PROBE	X	
4.08	4	N1903X	FUL RAPID LD VLV OPN	X	
4.14	18	N1923X	FUL RAPID VLV CLSD	X	
4.43	78	P1898X	HW PROBE @ STA 910	X	
4.44	79	P1899X	AA PROBE @ STA 910	X	
4.60	15	N1919X	F STK PRESS CLSD	X	
5.74	79	P1899X	AA PROBE @ STA 910		X
5.75	78	P1898X	HW PROBE @ STA 910		X
6.43	6	P1999X	MSL FUELED 100%		X

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CONVAIR ASTRONAUTICS

REPORT ~~IN~~ 131/

PAGE 15

1-95 428 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
6.44	3	N1902X	F FINE LOAD VLV CLSD	X	
6.44	10	N1914X	F FINE LOAD VLV OPEN	X	
6.44	29	N1971X	AA FUEL 100% PROBE	X	
6.45	12	P1967X	F MSL F/D VLV OPEN	X	
6.48	11	P1966X	F MSL F/D VLV CLSD	X	
6.49	14	N1918X	F GND F/D VLV OPEN	X	
6.53	13	N1917X	F GRD F/D VLV CLSD	X	
6.56	6	P1999X	MSL FUELED 100%	X	
6.57	29	N1971X	AA FUEL 100% PROBE		X
6.74	55	N1936X	LO2 LOADING PRESS	X	
6.78	44	N1907X	LO2 STK P VLV A CLSD		X
6.88	65	N1889X	INTER LO2 STK PRESS	X	
7.18	79	P1899X	AA PROBE @ STA 910	X	
7.45	76	P1896X	HW PROBE @ STA 888	X	
7.45	77	P1897X	AA PROBE @ STA 888	X	
7.61	79	P1899X	AA PROBE @ STA 910		X
7.67	75	P1895X	AA PROBE @ STA 866	X	
7.67	79	P1899X	AA PROBE @ STA 910	X	
8.97	37	P1890X	HW PROBE @ STA 700	X	
9.22	79	P1899X	AA PROBE @ STA 910		X
9.28	79	P1899X	AA PROBE @ STA 910	X	
9.29	77	P1897X	AA PROBE @ STA 888		X
9.39	77	P1897X	AA PROBE @ STA 888	X	
9.43	38	P1891X	AA PROBE @ STA 700	X	
9.84	31	N1973X	HW LO2 RAPID SIG/90%	X	
9.90	42	N1905X	L RAPID LD VLV OPEN	X	
9.96	54	N1934X	L RAPID LD VLV CLSD	X	
11.58	33	N1975X	HW LO2 FIN SIG 99%	X	
11.58	46	P1998X	MSL LO2 @ 100%		X
11.59	51	N1931X	LO2 FINE LD VLV OPEN	X	
11.62	43	N1906X	LO2 FINE LD VLV CLSD	X	
11.62	49	N1929X	LO2 GND F/D VLV CLSD	X	
11.63	50	N1930X	LO2 GND F/D VLV OPEN	X	
11.72	66	N1891X	LO2 NOT IN UPPER LN	X	
12.18	56	N1949X	LO2 LN LIQ DET/INTRM	X	
12.73	62	N1966X	LO2 DRAIN COMPLETE	X	
12.73	63	N1967X	LO2 MSL F/D VLV OPEN	X	
12.76	52	N1932X	LO2 TOPPING VLV CLSD	X	
12.76	64	N1968X	LO2 MSL F/D VLV CLSD	X	
12.80	50	N1930X	LO2 GND F/D VLV OPEN		X
12.82	49	N1929X	LO2 GND F/D VLV CLSD		X
12.84	49	N1929X	LO2 GND F/D VLV CLSD	X	
12.84	50	N1930X	LO2 GND F/D VLV OPEN	X	
12.96	44	N1907X	LO2 STK P VLV A CLSD	X	

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CONVAIR ASTRONAUTICS

REPORT ~~EM~~ 1310

PAGE 16

1-95 428 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
13.06	43	N1906X	L02 FINE LD VLV CLSD		X
13.08	51	N1931X	L02 FINE LD VLV OPEN		X
13.10	56	N1949X	L02 LN L10 DET/INTRM		X
13.27	66	N1891X	L02 NOT IN UPPER LN		X
13.28	47	N1925X	L02 COOLDOWN ST SW		X
13.28	51	N1931X	L02 FINE LD VLV OPEN	X	
13.30	43	N1906X	L02 FINE LD VLV CLSD	X	
13.85	33	N1975X	HW L02 FIN SIG 99%		X
14.11	65	N1889X	INTER L02 STK PRESS		X
14.64	66	N1891X	L02 NOT IN UPPER LN	X	
14.79	50	N1930X	L02 GND F/D VLV OPEN		X
14.80	52	N1932X	L02 TOPPING VLV CLSD		X
14.80	59	N1963X	L MAIN DRN VLV CLSD		X
14.81	49	N1929X	L02 GND F/D VLV CLSD		X
14.81	64	N1968X	L02 MSL F/D VLV CLSD		X
14.82	66	N1891X	L02 NOT IN UPPER LN		X
14.83	53	N1933X	L02 TOPPING VLV OPEN	X	
14.85	60	N1964X	L MAIN DRN VLV OPEN		X
14.85	63	N1967X	L02 MSL F/D VLV OPEN		X
14.86	46	P1998X	MSL L02 @ 100%	X	
16.32	31	N1973X	HW L02 RAPID SIG/90%		X

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CONVAIR ASTRONAUTICS

REPORT ~~RM 1310~~

PAGE 17

1-95 428 SEQ DATA

NOTE

1. THESE PENS ACTIVATED THROUGHOUT THE TEST

7	N1911X	EMER MSL PRESS COND
9	N1913X	F PREPRESS VLV 1 OPN
22	N1956X	FUEL STK VT VLV CLSD
23	N1960X	F MAIN DRN VLV CLSD
24	N1961X	F MAIN DRN VLV OPEN
40	P1893X	AA PROBE @ STA 793
45	P1988X	MSL LO2 @ 95%
57	N1951X	PRESS DUCT FUEL SNSR
58	N1962X	LN2 VENT VLV OPEN
68	F1897X	FLIGHT HE 1 VLV CLSD
69	N1892X	LN2 LOAD VLV CLSD
70	N1893X	LN2 LOAD VLV OPN
71	N1894X	LN2 STK P VLV CLSD
72	N1895X	LN2 STK VENT VLV NCL

2. THESE PENS DEACTIVATED THROUGHOUT THE TEST

5	P1997X	MSL FUELED 95%
20	N1955X	FUEL DRAIN START SW
25	N1965X	FUL DRAIN COMPLETE
28	N1970X	AA FUEL 95% PROBE
30	N1972X	AA FUEL 99.89% PROBE
32	N1974X	HW LO2 RU 95% SIG
35	N1977X	HW LO2 TOPG COF SIG
36	N1978X	HW LO2 EM SIG 100.2%
39	P1892X	HW PROBE @ STA 793
67	F1896X	LN2 INFLIGHT HE LOAD
73	P1673X	LO2 ST TK FULL
74	P1894X	LO2 95% EMERG COF

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CONVAIR ASTRONAUTICS

REPORT RM 1310

PAGE 18

195 429 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
0.00	8	N1912X	FUEL LOAD START SW	X	
0.00	2	N1901X	F PREPRES 1 VLV CLSD	X	
0.00	47	N1925X	LO2 COOLDOWN ST SW	X	
0.00	48	N1925X	LO2 TK VENT VLV CLSD		X
0.02	9	N1913X	F PREPRESS VLV 1 OPN		X
0.40	3	N1902X	F FINE LOAD VLV CLSD		X
0.40	3	N1912X	FUEL LOAD START SW		X
0.41	9	N1913X	F PREPRESS VLV 1 OPN	X	
0.41	11	P1966X	F MSL F/D VLV CLSD		X
0.41	13	N1917X	F GRD F/D VLV CLSD		X
0.41	15	N1919X	F STK PRESS CLSD		X
0.42	2	N1901X	F PREPRES 1 VLV CLSD		X
0.43	10	N1914X	F FINE LOAD VLV OPEN		X
0.44	14	N1918X	F GND F/D VLV OPEN		X
0.45	12	P1967X	F MSL F/D VLV OPEN		X
0.47	26	N1890X	INTER FUL STK PRESS	X	
0.62	19	N1943X	F LN LIQ DET/INTERM		X
0.82	17	N1922X	FUL RAPID LD SIGNAL		X
1.81	18	N1923X	FUL RAPID VLV CLSD		X
2.09	16	N1921X	FUEL LOADING PRESS	X	
2.11	43	N1906X	LO2 FINE LD VLV CLSD		X
2.11	52	N1932X	LO2 TOPPING VLV CLSD		X
2.11	64	N1968X	LO2 MSL F/D VLV CLSD		X
2.11	66	N1891X	LO2 NOT IN UPPER LN		X
2.12	50	N1930X	LO2 GND F/D VLV OPEN		X
2.13	49	N1929X	LO2 GND F/D VLV CLSD		X
2.13	53	N1933X	LO2 TOPPING VLV OPEN		X
2.14	44	N1907X	LO2 STK P VLV A CLSD		X
2.14	51	N1931X	LO2 FINE LD VLV OPEN		X
2.14	54	N1934X	L RAPID LD VLV CLSD		X
2.15	63	N1967X	LO2 MSL F/D VLV OPEN		X
2.20	42	N1905X	L RAPID LD VLV OPEN		X
2.22	44	N1907X	LO2 STK P VLV A CLSD	X	
2.25	44	N1907X	LO2 STK P VLV A CLSD		X
2.32	56	N1949X	LO2 LN LIQ DET/INTRM		X
2.41	44	N1907X	LO2 STK P VLV A CLSD	X	
2.93	56	N1949X	LO2 LN LIQ DET/INTRM	X	
3.72	56	N1949X	LO2 LN LIQ DET/INTRM		X
4.06	27	N1969X	AA FUEL 90% PROBE	X	
4.15	18	N1923X	FUL RAPID VLV CLSD	X	
4.50	79	P1899X	AA PROBE @ STA 910	X	
4.62	15	N1919X	F STK PRESS CLSD	X	
4.71	78	P1898X	HW PROBE @ STA 910	X	
5.28	78	P1898X	HW PROBE @ STA 910		X

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CONVAIR ASTRONAUTICS

REPORT NO 130

PAGE 19

195 429 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
5.28	79	P1899X	AA PROBE @ STA 910		X
6.34	29	N1971X	AA FUEL 100% PROBE	X	
6.35	6	P1999X	MSL FUELED 100%		X
6.35	10	N1914X	F FINE LOAD VLV OPEN	X	
6.36	3	N1902X	F FINE LOAD VLV CLSD	X	
6.36	12	P1967X	F MSL F/D VLV OPEN	X	
6.40	11	P1966X	F MSL F/D VLV CLSD	X	
6.41	14	N1918X	F GND F/D VLV OPEN	X	
6.44	13	N1917X	F GRD F/D VLV CLSD	X	
6.48	6	P1999X	MSL FUELED 100%	X	
6.48	29	N1971X	AA FUEL 100% PROBE		X
6.65	56	N1949X	LO2 LN LIO DET/INTRM	X	
6.68	44	N1907X	LO2 STK P VLV A CLSD		X
6.81	65	N1889X	INTER LO2 STK PRESS	X	
7.09	78	P1898X	HW PROBE @ STA 910	X	
7.10	79	P1899X	AA PROBE @ STA 910	X	
7.38	76	P1896X	HW PROBE @ STA 888	X	
7.39	77	P1897X	AA PROBE @ STA 888	X	
7.48	77	P1897X	AA PROBE @ STA 888		X
7.58	78	P1898X	HW PROBE @ STA 910		X
7.62	78	P1898X	HW PROBE @ STA 910	X	
7.63	74	P1894X	LO2 95% EMERG COF	X	
8.21	77	P1897X	AA PROBE @ STA 888	X	
8.67	51	N1931X	LO2 FINE LD VLV OPEN	X	
8.68	44	N1907X	LO2 STK P VLV A CLSD	X	
8.68	53	N1933X	LO2 TOPPING VLV OPEN	X	
8.69	43	N1906X	LO2 FINE LD VLV CLSD	X	
8.70	42	N1905X	L RAPID LD VLV OPEN	X	
8.70	52	N1932X	LO2 TOPPING VLV CLSD	X	
8.76	49	N1929X	LO2 GND F/D VLV CLSD	X	
8.76	54	N1934X	L RAPID LD VLV CLSD	X	
8.77	50	N1930X	LO2 GND F/D VLV OPEN	X	
8.78	63	N1967X	LO2 MSL F/D VLV OPEN	X	
8.81	64	N1968X	LO2 MSL F/D VLV CLSD	X	
9.00	50	N1930X	LO2 GND F/D VLV OPEN		X
9.01	49	N1929X	LO2 GND F/D VLV CLSD		X
9.05	49	N1929X	LO2 GND F/D VLV CLSD	X	
9.07	50	N1930X	LO2 GND F/D VLV OPEN	X	
9.16	47	N1925X	LO2 COOLDOWN ST SW		X
9.17	48	N1926X	LO2 TK VENT VLV CLSD	X	
9.28	66	N1891X	LO2 NOT IN UPPER LN	X	
9.73	65	N1889X	INTER LO2 STK PRESS		X
10.19	50	N1930X	LO2 GND F/D VLV OPEN		X
10.19	59	N1963X	L MAIN DRN VLV CLSD		X

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 20

195 429 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
10.20	52	N1932X	LO2 TOPPING VLV CLSD		X
10.21	49	N1929X	LO2 GND F/D VLV CLSD		X
10.21	53	N1933X	LO2 TOPPING VLV OPEN		X
10.22	64	N1968X	LO2 MSL F/D VLV CLSD		X
10.23	66	N1891X	LO2 NOT IN UPPER LN		X
10.24	60	N1964X	L MAIN OPH VLV OPEN		X
10.26	63	N1967X	LO2 MSL F/D VLV OPEN		Y

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CONVAIR ASTRONAUTICS

REPORT NO 1310

PAGE 21

195 429 SEQ DATA

NOTE

1. THESE PENS ACTIVATED THROUGHOUT THE TEST

7	N1911X	EMER MSL PRESS COND
22	N1956X	FUEL STK VT VLV CLSD
23	N1960X	F MAIN DRN VLV CLSD
24	N1961X	F MAIN DRN VLV OPEN
45	P1988X	MSL LO2 @ 95%
46	P1998X	MSL LO2 @ 100%
55	N1936X	LO2 LOADING PRESS
57	N1951X	PRESS DUCT FUEL SNSR
58	N1962X	LN2 VENT VLV OPEN
68	F1897X	FLIGHT HE 1 VLV CLSD
69	N1892X	LN2 LOAD VLV CLSD
70	N1893X	LN2 LOAD VLV OPN
71	N1894X	LN2 STK P VLV CLSD
72	N1895X	LN2 STK VENT VLV NCL
75	P1895X	AA PROBE @ STA 866

2. THESE PENS DEACTIVATED THROUGHOUT THE TEST

5	P1997X	MSL FUELED 95%
20	N1955X	FUEL DRAIN START SW
25	N1965X	FUL DRAIN COMPLETE
28	N1970X	AA FUEL 95% PROBE
30	N1972X	AA FUEL 99.89% PROBE
31	N1973X	HW LO2 RAPID SIG/90%
32	N1974X	HW LO2 BU 95% SIG
33	N1975X	HW LO2 FIN SIG 99%
35	N1977X	HW LO2 TOPG COF SIG
36	N1978X	HW LO2 EM SIG 100.2%
37	P1890X	HW PROBE @ STA 700
38	P1891X	AA PROBE @ STA 700
39	P1892X	HW PROBE @ STA 793
40	P1893X	AA PROBE @ STA 793
62	N1966X	LO2 DRAIN COMPLETE
67	F1896X	LN2 INFLIGHT HE LOAD
73	P1673X	LO2 ST TK FULL

3. PEN #4 DID NOT INK

4	N1903X	FUL RAPID LD VLV OPN
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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 22

195 430 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
0.00	8	N1912X	FUEL LOAD START SW	X	
0.00	2	N1901X	F PREPRES 1 VLV CLSD		X
0.00	47	N1925X	LO2 COOLDOWN ST SW	X	
0.00	48	N1926X	LO2 TK VENT VLV CLSD		X
0.02	9	N1913X	F PREPRESS VLV 1 OPN		X
0.42	15	N1919X	F STK PRESS CLSD		X
0.43	3	N1902X	F FINE LOAD VLV CLSD		X
0.43	8	N1912X	FUEL LOAD START SW		X
0.43	9	N1913X	F PREPRESS VLV 1 OPN	X	
0.43	11	P1966X	F MSL F/D VLV CLSD		X
0.44	2	N1901X	F PREPRES 1 VLV CLSD	X	
0.44	13	N1917X	F GRD F/D VLV CLSD		X
0.45	10	N1914X	F FINE LOAD VLV OPEN		X
0.46	14	N1918X	F GND F/D VLV OPEN		X
0.47	12	P1967X	F MSL F/D VLV OPEN		X
0.47	26	N1890X	INTER FUL STK PRESS	X	
0.71	62	N1966X	LO2 DRAIN COMPLETE		X
1.00	17	N1922X	FUL RAPID LD SIGNAL		X
1.93	18	N1923X	FUL RAPID VLV CLSD		X
2.17	43	N1906X	LO2 FINE LD VLV CLSD		X
2.17	52	N1932X	LO2 TOPPING VLV CLSD		X
2.17	64	N1968X	LO2 MSL F/D VLV CLSD		X
2.18	16	N1921X	FUEL LOADING PRESS	X	
2.18	50	N1930X	LO2 GND F/D VLV OPEN		X
2.19	44	N1907X	LO2 STK P VLV A CLSD		X
2.19	49	N1929X	LO2 GND F/D VLV CLSD		X
2.19	53	N1933X	LO2 TOPPING VLV OPEN		X
2.20	51	N1931X	LO2 FINE LD VLV OPEN		X
2.20	54	N1934X	L RAPID LD VLV CLSD		X
2.21	63	N1967X	LO2 MSL F/D VLV OPEN		X
2.25	42	N1905X	L RAPID LD VLV OPEN		X
2.28	44	N1907X	LO2 STK P VLV A CLSD	X	
2.32	66	N1891X	LO2 NOT IN UPPER LN		X
2.37	56	N1949X	LO2 LN LIQ DET/INTRM		X
2.76	56	N1949X	LO2 LN LIQ DET/INTRM	X	
3.32	56	N1949X	LO2 LN LIQ DET/INTRM		X
3.91	56	N1949X	LO2 LN LIQ DET/INTRM	X	
4.26	27	N1969X	AA FUEL 90% PROBE	X	
4.28	4	N1903X	FUL RAPID LD VLV OPN	X	
4.31	79	P1899X	AA PROBE @ STA 910	X	
4.33	79	P1899X	AA PROBE @ STA 910		X
4.35	18	N1923X	FUL RAPID VLV CLSD	X	
4.55	56	N1949X	LO2 LN LIQ DET/INTRM		X
4.59	77	P1897X	AA PROBE @ STA 888	X	

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 23

195 430 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
4.59	78	P1898X	HW PROBE @ STA 910	X	
4.68	15	N1919X	F STK PRESS CLSD	X	
4.72	77	P1897X	AA PROBE @ STA 888		X
4.96	79	P1899X	AA PROBE @ STA 910	X	
6.71	6	P1999X	MSL FUELED 100%		X
6.71	10	N1914X	F FINE LOAD VLV OPEN	X	
6.71	29	N1971X	AA FUEL 100% PROBE	X	
6.72	3	N1902X	F FINE LOAD VLV CLSD	X	
6.73	12	P1967X	F MSL F/D VLV OPEN	X	
6.76	11	P1966X	F MSL F/D VLV CLSD	X	
6.84	6	P1999X	MSL FUELED 100%	X	
6.84	29	N1971X	AA FUEL 100% PROBE		X
6.89	17	N1922X	FUL RAPID LD SIGNAL	X	
6.99	55	N1936X	LO2 LOADING PRESS	X	
7.03	44	N1907X	LO2 STK P VLV A CLSD		X
7.07	76	P1896X	HW PROBE @ STA 888	X	
7.10	76	P1896X	HW PROBE @ STA 888		X
7.17	65	N1889X	INTER LO2 STK PRESS	X	
7.19	76	P1896X	HW PROBE @ STA 888	X	
7.20	79	P1899X	AA PROBE @ STA 910		X
7.28	14	N1918X	F GND F/D VLV OPEN	X	
7.28	19	N1943X	F LN LIQ DET/INTERM	X	
7.31	13	N1917X	F GRD F/D VLV CLSD	X	
7.57	75	P1895X	AA PROBE @ STA 866	X	
7.57	79	P1899X	AA PROBE @ STA 910	X	
8.92	37	P1890X	HW PROBE @ STA 700	X	
9.08	79	P1899X	AA PROBE @ STA 910		X
9.10	42	N1905X	L RAPID LD VLV OPEN	X	
9.10	44	N1907X	LO2 STK P VLV A CLSD	X	
9.10	77	P1897X	AA PROBE @ STA 888	X	
9.15	54	N1934X	L RAPID LD VLV CLSD	X	
9.19	38	P1891X	AA PROBE @ STA 700	X	
9.20	79	P1899X	AA PROBE @ STA 910	X	
9.32	54	N1934X	L RAPID LD VLV CLSD		X
9.37	42	N1905X	L RAPID LD VLV OPEN		X
9.37	44	N1907X	LO2 STK P VLV A CLSD		X
9.88	31	N1973X	HW LO2 RAPID SIG/90%	X	
10.00	42	N1905X	L RAPID LD VLV OPEN	X	
10.00	44	N1907X	LO2 STK P VLV A CLSD	X	
10.05	54	N1934X	L RAPID LD VLV CLSD	X	
11.80	46	P1998X	MSL LO2 @ 100%		X
11.81	33	N1975X	HW LO2 FIN SIG 99%	X	
11.81	51	N1931X	LO2 FINE LD VLV OPEN	X	
11.83	43	N1906X	LO2 FINE LD VLV CLSD	X	

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CONVAIR ASTRONAUTICS

REPORT FM 1310

PAGE 24

195 430 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
11.84	49	N1929X	LO2 GND F/D VLV CLSD	X	
11.85	50	N1930X	LO2 GND F/D VLV OPEN	X	
11.95	66	N1891X	LO2 NOT IN UPPER LN	X	
12.38	56	N1949X	LO2 LN LIC DET/INTRM	X	

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CONVAIR | ASTRONAUTICS

REPORT RM 1310

PAGE 25

195 430 SEQ DATA

NOTE

1. THESE PENS ACTIVATED THROUGHOUT THE TEST

7	N1911X	EMER MSL PRESS COND
22	N1956X	FUEL STK VT VLV CLSD
23	N1960X	F MAIN DRN VLV CLSD
24	N1961X	F MAIN DRN VLV OPEN
40	P1893X	AA PROBE @ STA 793
45	P1988X	MSL LO2 @ 95%
57	N1951X	PRESS DUCT FUEL SNSR
58	N1962X	LN2 VENT VLV OPEN
59	N1963X	L MAIN DRN VLV CLSD
60	N1964X	L MAIN DRN VLV OPEN
68	F1897X	FLIGHT HE 1 VLV CLSD
69	N1892X	LN2 LOAD VLV CLSD
70	N1893X	LN2 LOAD VLV OPN
71	N1894X	LN2 STK P VLV CLSD
72	N1895X	LN2 STK VENT VLV NCL

2. THESE PENS DEACTIVATED THROUGHOUT THE TEST

5	P1997X	MSL FUELED 95%
20	N1955X	FUEL DRAIN START SW
25	N1965X	FUEL DRAIN COMPLETE
28	N1970X	AA FUEL 95% PROBE
30	N1972X	AA FUEL 99.89% PROBE
32	N1974X	HW LO2 BU 95% SIG
35	N1977X	HW LO2 TOPG COF SIG
36	N1978X	HW LO2 EM SIG 100.2%
39	P1892X	HW PROBE @ STA 793
67	F1896X	LN2 INFLIGHT HE LOAD
73	P1673X	LO2 ST TK FULL
74	P1894X	LO2 95% EMERG COF

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CONVAIR ASTRONAUTICS

REPORT ~~EM~~ 1310

PAGE 26

195 431 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
0.00	8	N1912X	FUEL LOAD START SW	X	
0.00	2	N1901X	F PREPRESS 1 VLV CLSD		X
0.00	47	N1925X	LO2 COOLDOWN ST SW	X	
0.00	48	N1926X	LO2 TK VENT VLV CLSD		X
0.02	9	N1913X	F PREPRESS VLV 1 OPN		X
0.41	3	N1902X	F FINE LOAD VLV CLSD		X
0.41	8	N1912X	FUEL LOAD START SW		X
0.41	9	N1913X	F PREPRESS VLV 1 OPN	X	
0.41	11	P1966X	F MSL F/D VLV CLSD		X
0.41	13	N1917X	F GRD F/D VLV CLSD		X
0.42	2	N1901X	F PREPRESS 1 VLV CLSD	X	
0.42	15	N1919X	F STK PRESS CLSD		X
0.43	10	N1914X	F FINE LOAD VLV OPEN		X
0.44	14	N1918X	F GND F/D VLV OPEN		X
0.46	12	P1967X	F MSL F/D VLV OPEN		X
0.47	26	N1890X	INTER FUL STK PRESS	X	
0.62	19	N1943X	F LN LIQ DET/INTERM		X
0.67	15	N1919X	F STK PRESS CLSD	X	
0.85	17	N1922X	FUL RAPID LD SIGNAL		X
1.82	18	N1923X	FUL RAPID VLV CLSD		X
1.86	15	N1919X	F STK PRESS CLSD		X
1.87	4	N1903X	FUL RAPID LD VLV OPN		X
2.12	43	N1906X	LO2 FINE LD VLV CLSD		X
2.12	50	N1930X	LO2 GND F/D VLV OPEN		X
2.12	64	N1968X	LO2 MSL F/D VLV CLSD		X
2.13	49	N1929X	LO2 GND F/D VLV CLSD		X
2.13	52	N1932X	LO2 TOPPING VLV CLSD		X
2.13	66	N1891X	LO2 NOT IN UPPEP LN		X
2.14	44	N1907X	LO2 STK P VLV A CLSD		X
2.14	51	N1931X	LO2 FINE LD VLV OPEN		X
2.14	53	N1933X	LO2 TOPPING VLV OPEN		X
2.15	54	N1934X	L RAPID LD VLV CLSD		X
2.16	63	N1967X	LO2 MSL F/D VLV OPEN		X
2.20	42	N1905X	L RAPID LD VLV OPEN		X
2.23	44	N1907X	LO2 STK P VLV A CLSD	X	
2.38	56	N1949X	LO2 LN LIQ DET/INTRM		X
2.42	44	N1907X	LO2 STK P VLV A CLSD	X	
2.50	44	N1907X	LO2 STK P VLV A CLSD		X
2.80	62	N1966X	LO2 DRAIN COMPLETE		X
2.88	56	N1949X	LO2 LN LIQ DET/INTRM	X	
3.50	56	N1949X	LO2 LN LIQ DET/INTRM		X
4.05	27	N1969X	AA FUEL 90% PROBE	X	
4.07	4	N1903X	FUL RAPID LD VLV OPN	X	
4.14	18	N1923X	FUL RAPID VLV CLSD	X	

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 27

195 431 SEQ DATA

TIME	PEN #	MEAS #	DESCRIPTION	ACT	DEACT
4.43	79	P1899X	AA PROBE @ STA 910	X	
4.49	15	N1919X	F STK PRESS CLSD	X	
4.72	78	P1898X	HW PROBE @ STA 910	X	
6.03	79	P1899X	AA PROBE @ STA 910		X
6.04	78	P1898X	HW PROBE @ STA 910		X
6.40	6	P1999X	MSL FUELED 100%		X
6.40	10	N1914X	F FINE LOAD VLV OPEN	X	
6.41	3	N1902X	F FINE LOAD VLV CLSD	X	
6.41	12	P1967X	F MSL F/D VLV OPEN	X	
6.41	29	N1971X	AA FUEL 100% PROBE	X	
6.45	11	P1966X	F MSL F/D VLV CLSD	X	
6.53	6	P1999X	MSL FUELED 100%	X	
6.58	17	N1922X	FUL RAPID LD SIGNAL	X	
6.59	29	N1971X	AA FUEL 100% PROBE		X
6.70	55	N1936X	LO2 LOADING PRESS		X
6.74	44	N1907X	LO2 STK P VLV A CLSD		X
6.86	65	N1889X	INTER LO2 STK PRESS	X	
6.97	14	N1918X	F GND F/D VLV OPEN	X	
7.00	13	N1917X	F GRD F/D VLV CLSD	X	
7.14	78	P1898X	HW PROBE @ STA 910	X	
7.15	79	P1899X	AA PROBE @ STA 910	X	
7.22	44	N1907X	LO2 STK P VLV A CLSD	X	
7.32	44	N1907X	LO2 STK P VLV A CLSD		X
7.45	76	P1896X	HW PROBE @ STA 888	X	
7.50	79	P1899X	AA PROBE @ STA 910		X
7.62	79	P1899X	AA PROBE @ STA 910	X	
7.63	75	P1895X	AA PROBE @ STA 866	X	
8.98	37	P1890X	HW PROBE @ STA 700	X	
9.20	79	P1899X	AA PROBE @ STA 910		X
9.30	77	P1897X	AA PROBE @ STA 888	X	
9.30	79	P1899X	AA PROBE @ STA 910	X	
9.32	38	P1891X	AA PROBE @ STA 700	X	
9.88	31	N1973X	HW LO2 RAPID SIG/90%	X	
9.90	42	N1905X	L RAPID LD VLV OPEN	X	
9.96	54	N1934X	L RAPID LD VLV CLSD	X	
11.57	46	P1998X	MSL LO2 @ 100%		X
11.57	51	N1931X	LO2 FINE LD VLV OPEN	X	
11.58	33	N1975X	HW LO2 FIN SIG 99%	X	
11.60	43	N1906X	LO2 FINE LD VLV CLSD	X	
11.61	49	N1929X	LO2 GND F/D VLV CLSD	X	
11.62	50	N1930X	LO2 GND F/D VLV OPEN	X	
11.69	66	N1891X	LO2 NOT IN UPPER LN	X	
12.11	56	N1949X	LO2 LN LIQ DET/INTRM	X	
13.23	44	N1907X	LO2 STK P VLV A CLSD	X	

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CONVAIR | ASTRONAUTICS

REPORT EM 1310

PAGE 28

195 431 SEQ DATA

NOTE

1. THESE PENS ACTIVATED THROUGHOUT THE TEST

7	N1911X	EMER MSL PRESS COND
22	N1956X	FUEL STK VT VLV CLSD
23	N1960X	F MAIN DRN VLV CLSD
24	N1961X	F MAIN DRN VLV OPEN
40	P1893X	AA PROBE @ STA 793
45	P1988X	MSL LO2 @ 95%
57	N1951X	PRESS DUCT FUEL SNSR
58	N1962X	LN2 VENT VLV OPEN
59	N1963X	L MAIN DRN VLV CLSD
60	N1964X	L MAIN DRN VLV OPEN
68	F1897X	FLIGHT HE 1 VLV CLSD
69	N1892X	LN2 LOAD VLV CLSD
70	N1893X	LN2 LOAD VLV OPN
71	N1894X	LN2 STK P VLV CLSD
72	N1895X	LN2 STK VENT VLV NCL

2. THESE PENS DEACTIVATED THROUGHOUT THE TEST

5	P1997X	MSL FUELED 95%
20	N1955X	FUEL DRAIN START SW
25	N1965X	FUL DRAIN COMPLETE
28	N1970X	AA FUEL 95% PROBE
30	N1972X	AA FUEL 99.89% PROBE
32	N1974X	HW LO2 RU 95% SIG
35	N1977X	HW LO2 TOPG COF SIG
36	N1978X	HW LO2 EM SIG 100.2%
39	P1892X	HW PROBE @ STA 793
67	F1896X	LN2 INFLIGHT HE LOAD
73	P1673X	LO2 ST TK FULL
74	P1894X	LO2 95% FMERG COF

3. PEN NO. 16 DID NOT INK

16	N1921X	FUEL LOADING PRESS
----	--------	--------------------

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CONVAIR  ASTRONAUTICS

REPORT ~~EM~~ 1310

PAGE 29

SECTION 5

Instrumentation Survey

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 30

INSTRUMENTATION FAILURE CODE

1. TRANSDUCER

- A. DAMAGED BEFORE TEST
- B. DAMAGED DURING TEST
- C. POWER SUPPLY LOSS
- D. EXCESSIVE ZERO SHIFT IN INSTRUMENTATION SYSTEM
- E. EXCESSIVE GAIN CHANGE IN INSTRUMENTATION SYSTEM
- F. OPEN CIRCUIT
- G. WATER IN TRANSDUCER
- H. SHORTED
- I. EXCESSIVE RANDOM NOISE

2. GRAPHIC RECORDER

- A. DATA PEN NOT WRITING
- B. TIMING PEN NOT WRITING
- C. PAPER DRIVE STOPPAGE
- D. RAN OUT OF PAPER DURING TEST
- E. EXCESSIVE RANDOM NOISE
- F. NO TIMING
- G. OFF SCALE
- H. PAPER DRIVE ON SLOW SPEED

3. OSCILLOGRAPHIC

- A. EXCESSIVE RANDOM NOISE
- B. BAD GALVANOMETER
- C. NO TIMING LINES
- D. NO TRACE IDENTIFIERS
- E. GALVANOMETER NOT SUITABLE
- F. RAN OUT OF PAPER DURING TEST
- G. PAPER DRIVE FAILURE
- H. NO TIMING CORRELATION

4. MAGNETIC TAPE RECORDERS

- A. SIGNAL OUT OF BAND
- B. EXCESSIVE SIGNAL DROPOUT
- C. EXCESSIVE RANDOM NOISE
- D. 60 CPS DISTURBANCE

- E. 400 CPS DISTURBANCE
- F. NO USEABLE TIMING
- G. NO SPEED LOCK-USED
EXTERNAL SPEED LOCK
- H. NO USEABLE 100 KC
CORRECTION
- I. NO USEABLE VOICE
- J. WRONG TAPE SPEED
- K. FAULTY TAPE

5. TELEMETRY /NOT APPLICABLE/

6. PRE-TEST MEASUREMENT CALIBRATION

- A. NEVER CALIBRATED
- B. NO USEABLE ZERO LEVEL
- C. NO USEABLE SENSE STEPS
- D. CALIBRATION NOT RECEIVED
FROM TEST SITE
- E. CALIBRATION SUSPECTED TO BE
INVALID

7. INSTRUMENTATION PROCEDURE

- A. WIRING REVERSED
- B. CALIBRATION RANGE INADEQUATE
- C. SYSTEM SENSITIVITY TOO HIGH
- D. SYSTEM SENSITIVITY TOO LOW
- E. IMPOSSIBLE TO MAKE MEASURE-
MENT
- F. MEASUREMENT NOT ATTEMPTED
- G. IMPROPER WIRING CONNECTION

8. MISCELLANY

- A. RECORD DAMAGED AT TEST SITE
- B. RECORD DAMAGED IN TEG
- C. RECORD NOT SENT TO TEG
- D. RECORD LOST IN TEG
- E. RECORD NOT IDENTIFIED AT SITE
- F. OSCILLOGRAPH DEVELOPMENT
FAULTY
- G. TRANSDUCER NOT MOUNTED
PROPERLY
- H. TRANSDUCER MNTD AT WRONG PLACE

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CONVAIR ASTRONAUTICS

REPORT RM 1310

PAGE 31

INSTRUMENTATION PROBLEM AREAS AND DEVIATIONS			
MALFUNCTIONS			
MEAS NO	DESCRIPTION	REASON	ACTION
N1980T P1682P	Run 428 Temp to Sample Btl Press Dif on LO2 Tank	Recorder malfunction Data pen not writing first 3 minute	Recorder repaired
P1887T P1903T	Eng Comp Amb by Cone Launcher LO2 In	Recorder malfunction Open circuit	Pen adjusted during run Recorder repaired Circuit repaired following new run
P1904T P1906T P1912T	B2 LO2 Pump Vol Ext B2 LO2 Pump Vol Int Launcher LO2 Out	Recorder malfunction Open probe on previous test Transducer shorted	Repaired following next run Measurement to be deleted Inspection revealed no short
P1887T P1903T P1904T P1906T	Run 429 Eng Comp Amb by Cone Launcher LO2 In B2 LO2 Pump Vol Ext B2 LO2 Pump Vol Int	Recorder malfunction Open circuit Recorder malfunction Open probe on previous test	Recorder repaired Circuit repaired Recorder repaired Measurement deleted
P1001P P1912T	Run 430 B1 LO2 Pump In Launcher LO2 Out	Data pen not writing first minute Transducer shorted	Pen adjusted during run Repair short after next run
P1020T P1912T	Run 431 B1 LO2 Pump In Launcher LO2 Out	Erratic circuit Transducer shorted	Circuit corrected Repaired short

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REPORT EM 1310

PAGE 32

SECTION 6

Test Preparations - Run 428

PRECOUNTDOWN SUMMARY

Precountdown operations were started at 0815 hours on 15 August 1959 and completed at 0935 hours for a consumed time of 80 minutes.

COUNTDOWN SUMMARY

Test Date: 15 August 1959

Planned Countdown Time	14	Minutes
Actual Countdown Time	16.38	Minutes
Total Recycled Time	5	Minutes
Total Hold Time	11	Minutes
Total Consumed Time	132.38	Minutes
Start of Countdown	1528	PDT
Zero Test Time	1240:23	PDT

COUNTDOWN TIME VS. EVENTS (Panel callouts capitalized)

<u>Time</u>	<u>Event</u>
1028	T-14, system ready report.
1029	T-13, Fuel Prevalves Open
1030	T-12, Load Start
1032:05	Fuel Rapid Load Open
1033	L02 tank pressure over redline, Emergency Pressurization recycle to T-14 and hold
1035	Manual L02 Drain Start
1043	L02 Drain Complete
1047	Fuel Drain Start
1050	Fuel Drain Complete
1120	Trouble corrected, holding for L02 system to warmup
1224	T-14, systems ready report
1225	T-13, Fuel Prevalves Open

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CONVAIR ASTRONAUTICS

REPORT EM 1310

PAGE 33

<u>Time</u>	<u>Event</u>
1226	T-12, Load Start
1228	Fuel Rapid Load Open
1229	Fuel at 50%
1230	93% fuel light on, Fuel Rapid Load Closed
1233:30	100% fuel light on, Fuel Fine Load Closed, Fuel Complete, FCU to Sequence III
1232:47	L02 Load Start
1233:42	Engine L02 at full
1234:45	L02 at 50%
1235:50	93% L02 light on, L02 Rapid Load Closed
1237:37	100% L02 light on, L02 Fine Load Closed
1238:23	L02 Line Drain Complete
1239	L02 Drain Start
1301:45	L02 Drain Complete, Restop FCU to Start
1302:27	Fuel Drain Start
1310:50	Fuel Drain Complete

Test Preparation - Run 429

PRECOUNTDOWN SUMMARY

The test article and facility were held in a ready condition following Run 428. Verification of readiness was completed at 1450 hours on 15 August 1959.

COUNTDOWN SUMMARY

Test Date: 15 August 1959
Start of Countdown: 1501:07 PDT

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REPORT EM 1310

PAGE 34

COUNTDOWN TIME VS. EVENTS (Panel callouts capitalized)

<u>Time</u>	<u>Event</u>
1501:07	T-14, systems ready report
1502:07	T-13, Fuel Prevalves Open
1503:07	T-12, Load Start
1505:53	Fuel Rapid Load Open
1506:58	Fuel at 50%
1508	93% fuel light on, Fuel Rapid Load Closed
1509:22	100% fuel light on, Fuel Fine Load Closed, Fuel Complete, PCU to Sequence IIL
1510:44	Engine LO2 tank full
1511:44	LO2 at 50%
1511:50	Manual LO2 Load Stop, LO2 at 53%
1512:15	LO2 Drain Start
1526:38	LO2 Drain Complete, restep PCU to Standby
1527:13	Fuel Drain Start
1535:38	Fuel Drain Complete, secure

Test Preparations - Run 430

PRECOUNTDOWN SUMMARY

Precountdown operations were started at 0810 hours on 19 August 1959 and completed at 0930 hours for a consumed time of 80 minutes.

COUNTDOWN SUMMARY

Test Date: 19 August 1959

Planned Countdown Time	14	Minutes
Actual Countdown Time	17	Minutes
Total Recycled Time	0	Minutes

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REPORT ~~FM~~ 1310

PAGE 35

Total Hold Time	0	Minutes
Total Consumed Time	17	Minutes
Start of Countdown	0947	PDT
Zero Test Time	1004	PDT

COUNTDOWN TIME VS. EVENTS (Panel callouts capitalized)

<u>Time</u>	<u>Event</u>
0947	T-14, systems ready report
0948	T-13, Fuel Prevalves Open
0949	T-12, Load Start
0951	Fuel Rapid Load Open
0953:15	93% fuel light on, Fuel Rapid Load Closed
0955:40	100% fuel light on, Fuel Fine Load Closed, Fuel Complete, PCU to Sequence IIL
0956	L02 Load Start
0957:12	Engine L02 tank full
0959:03	93% L02 light on, Rapid Load Closed, L02 at 72%
1000:50	100% L02 light on, L02 Fine Load Closed, L02 Topping Start
1001	Start planned 15 minute hold
1002	L02 Line Drain Complete
1016	L02 Topping Stop, Flight Pressurization
1017	Restep PCU to Sequence IIL, L02 Drain Start
1040	L02 Drain Complete, restep PCU to Standby
1041	Fuel Drain Start
1049	Fuel Drain Complete

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REPORT EM 1310

PAGE 36

Test Preparations - Run 431

PRECOUNTDOWN SUMMARY

The test article and facility were held in a ready condition following Run 430. Verification of readiness was completed at 1340 hours on 19 August 1959.

COUNTDOWN SUMMARY

Test Date: 19 August 1959

Planned Countdown Time	14	Minutes
Actual Countdown Time	16.33	Minutes
Total Recycled Time	0	Minutes
Total Hold Time	0	Minutes
Total Consumed Time	16.33	Minutes
Start of Countdown	1351	PDT
Zero Test Time	1407	PDT

COUNTDOWN TIME VS. EVENTS (Panel callouts capitalized)

<u>Time</u>	<u>Event</u>
1351	T-14, systems ready report
1352	T-13, Fuel Prevalves Open
1353	T-12, Load Start
1354:55	Fuel Rapid Load Open
1355:57	Fuel at 50%
1357:07	93% fuel light on, Fuel Rapid Load Closed
1359:26	100% fuel light on, Fuel Fine Load Closed, Fuel Complete, FCU to Sequence IIL
1359:45	L02 Load Start
1400:03	Fuel Line Drain Complete
1401:45	L02 at 50%
1402:53	93% L02 light on, L02 Rapid Load Closed

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CONVAIR ASTRONAUTICS

REPORT KM 1310

PAGE 37

<u>Time</u>	<u>Event</u>
1404:37	100% LO2 light on, LO2 Fine Load Closed, LO2 Topping Start
1405	Start planned 15 minute hold
1405:20	LO2 line drain complete
1417:30	100% LO2 light out
1420	LO2 Topping Stop
1420:15	Flight Pressurization
1421:10	Restop PCU to Sequence IIL
1421:40	LO2 Drain Start
1444	LO2 Drain Complete, restop PCU to Standby
1444:35	Fuel Drain Start
1453:08	Fuel Drain Complete, secure

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REPORT FM 1310

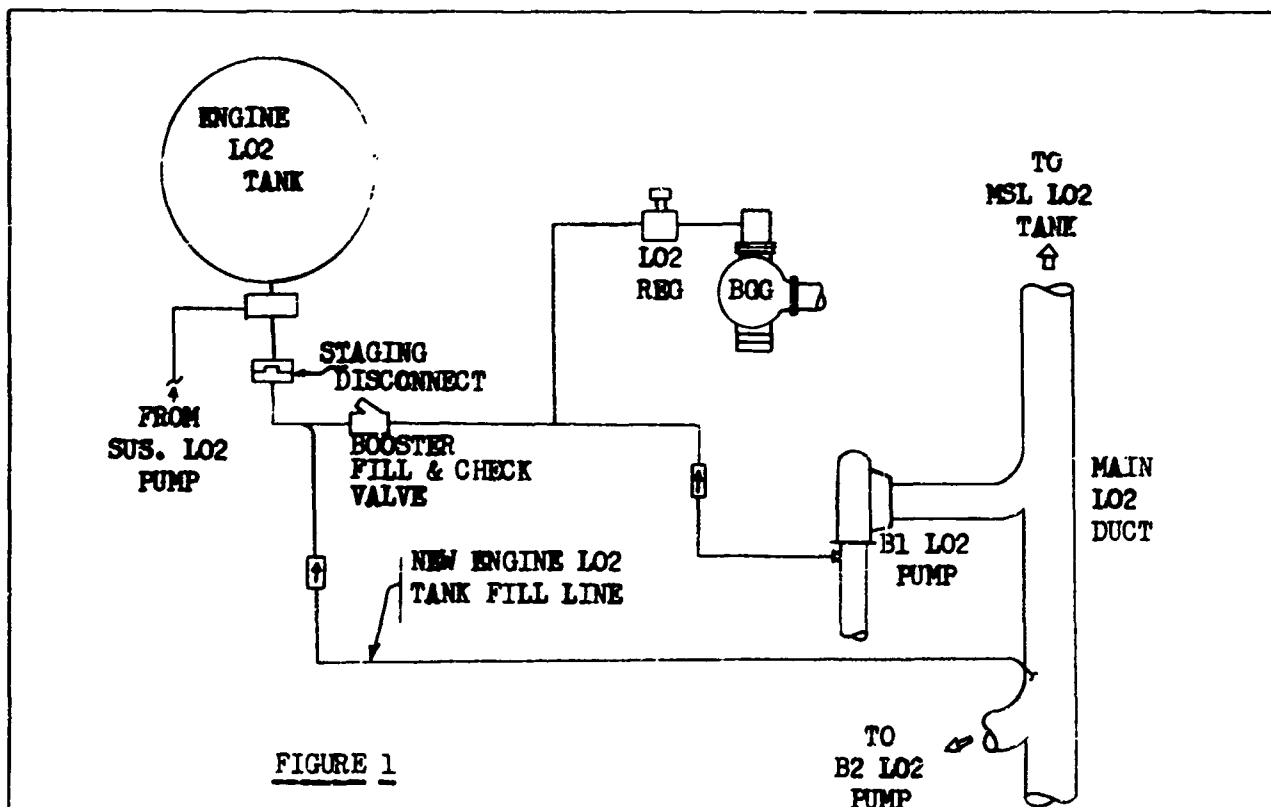
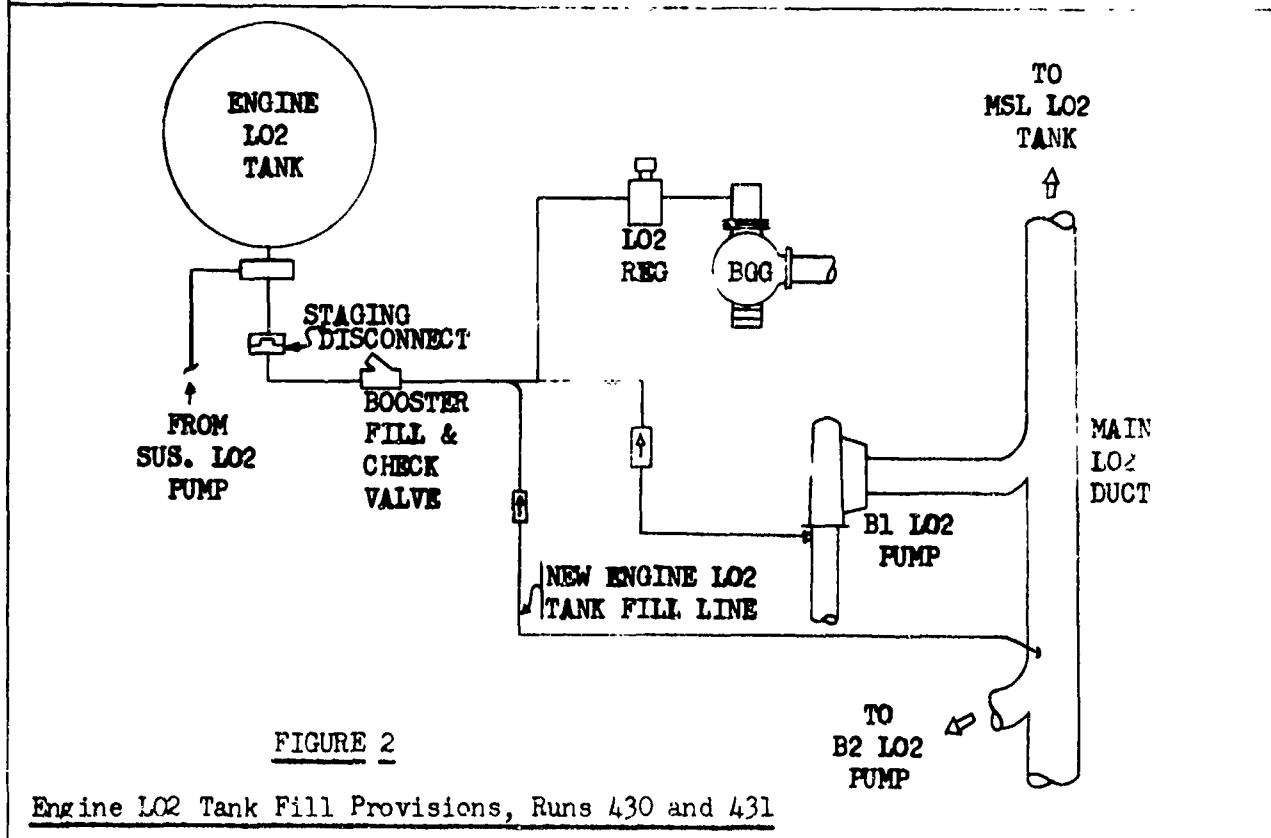
PAGE 38

A P P E N D I X 1

Figures

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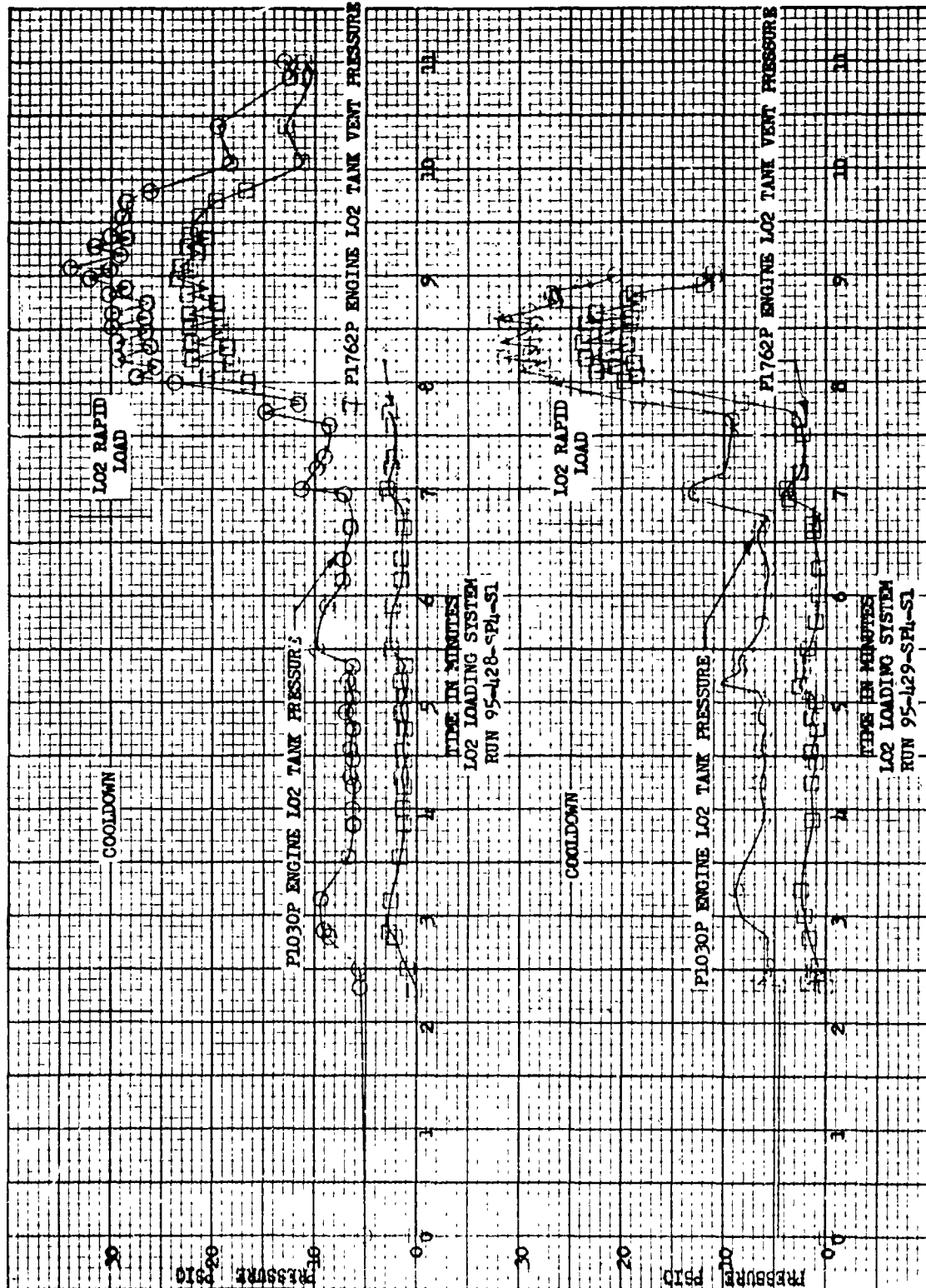
~~CONFIDENTIAL~~**FIGURE 1**Engine LO2 Tank Fill Provisions, Runs 428 and 429**FIGURE 2**Engine LO2 Tank Fill Provisions, Runs 430 and 431

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FIGURE



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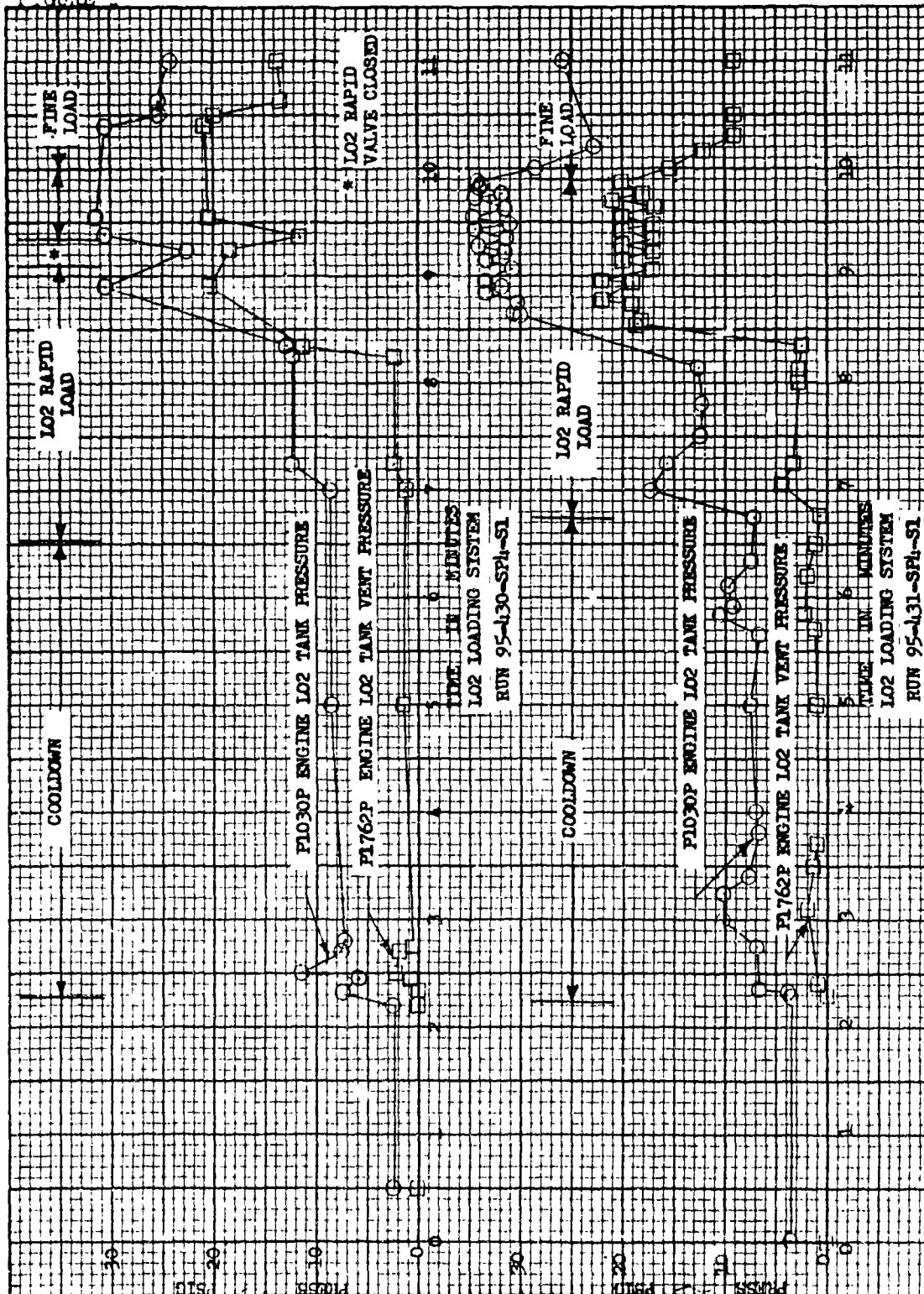
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REPORT EM -3.0

PAGE 4.

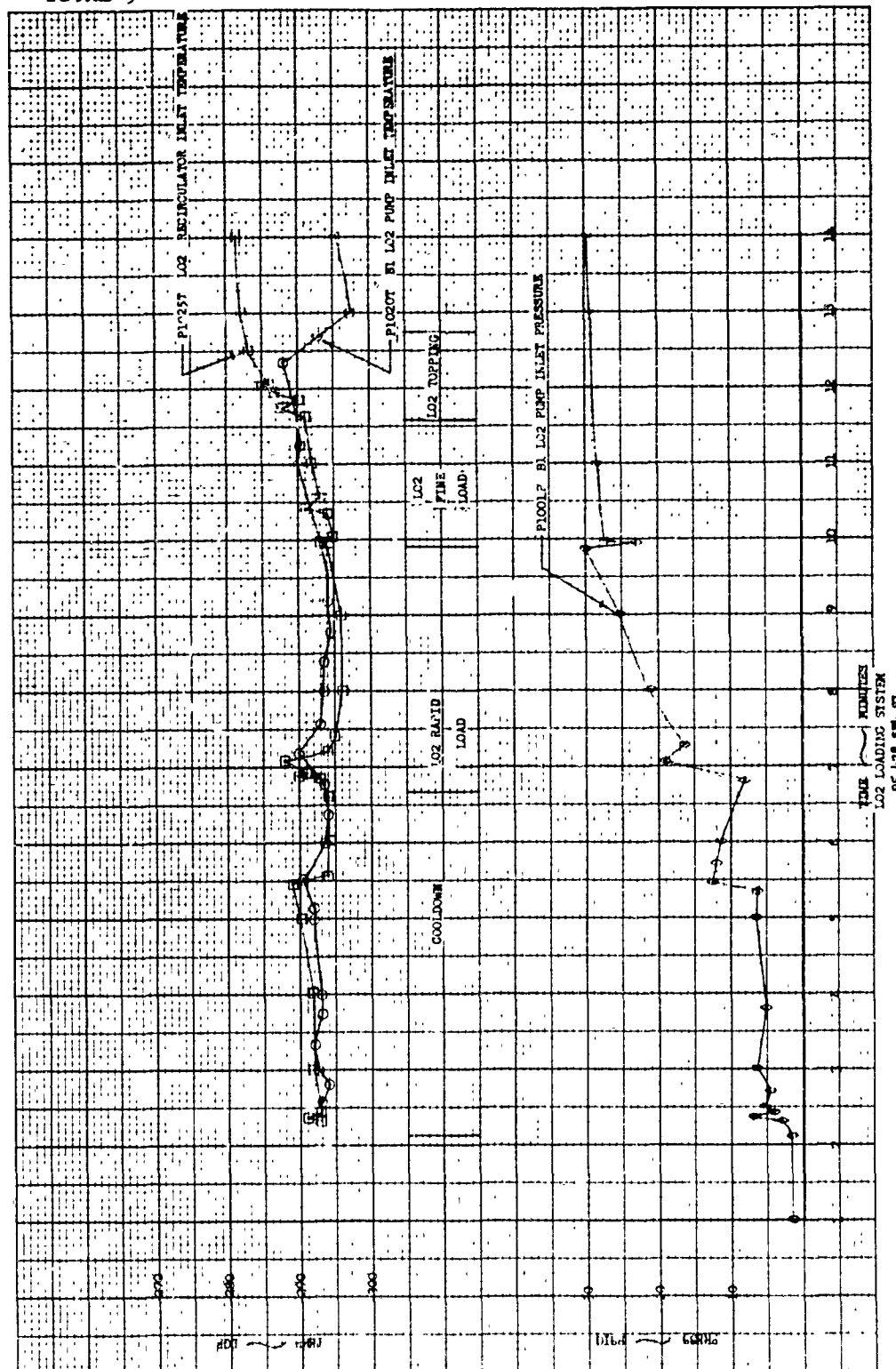
FIGURE



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FIGURE 5

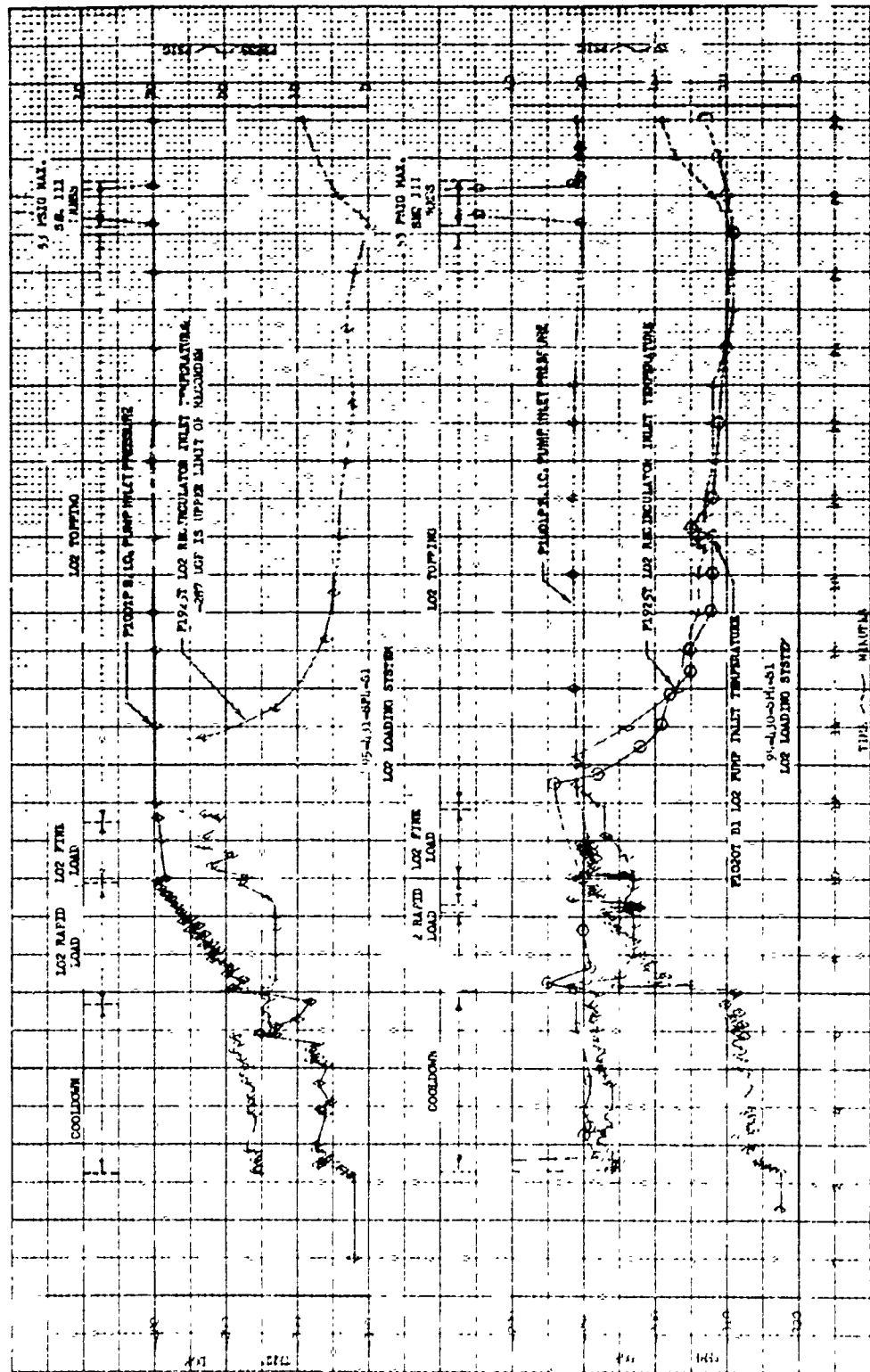


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EX 13.0
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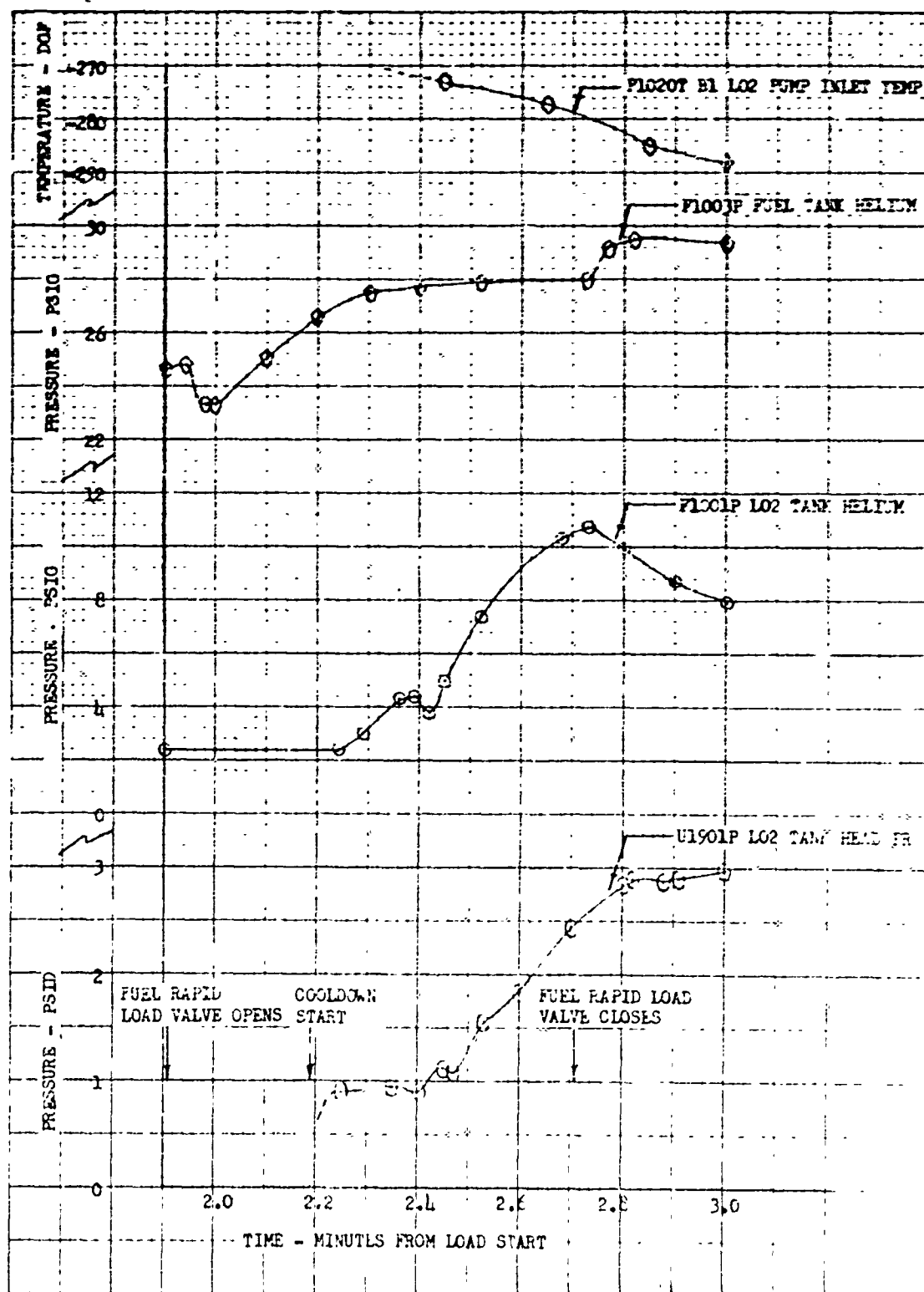
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REPORT EM 100

PAGE 1-1



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FORM A 702 2

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REPORT EM 1310

PAGE 45

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Operating Conditions

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REPORT EM 1310

PAGE 46

RED LINE VALUES EXCEEDED

The first attempt at Run 428 was aborted when Missile LO2 Tank Pressure (F1001P) rose to 10.7 PSIG during Sequence II-F pressures. The red line values for this measurement during Sequence II-F are a minimum of .9 PSIG and a maximum of 10 PSIG. All other measurements were satisfactory during Runs 428, 429, 430, 431. Red line values are tabulated in Test Directive ETD-OPH-5.

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CONVAIR ASTRONAUTICS

REPORT KM 1310

PAGE 47

Ambient Conditions

Run 428

Ambient Temperature: 78 DGF
Barometric Pressure: 27.505 In. Hg.
Relative Humidity: 33%
Wind Direction: SW
Wind Velocity: 3 Knots

Run 429

Ambient Temperature: 95 DGF
Barometric Pressure: 27.440 In. Hg.
Relative Humidity: 17%
Wind Direction: NE
Wind Velocity: 7 Knots

Run 430

Ambient Temperature: 68 DGF
Barometric Pressure: 27.430 In. Hg.
Relative Humidity: 52%
Wind Direction: WSW
Wind Velocity: 16 Knots

Run 431

Ambient Temperature: 75 DGF
Barometric Pressure: 27.395 In. Hg.
Relative Humidity: 37%
Wind Direction: SW
Wind Velocity: 21 Knots

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REPORT ~~PM~~ 1310

PAGE 48

A P P E N D I X 2

Test Article History

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REPORT EM 1310

PAGE 49

CONFIGURATION

The Phase III test article, missile assembly version number 7-31-27 is installed in the 1-95 Test Stand as required per 7-00027. This is a simulated operational missile which consists of "A", "B", "C" and "D" series components. These components are described in detail in the Block I Test Directive, Report No. ETD-OPH-4D. No significant changes have been made since the "D" revision, except as follows:

TVA 91457 authorizing connection of the Convair PLCU control units to Acoustica probes in the missile fuel tank has been cancelled and the Acoustica control units were restored to original configuration per TVA 91457B.

The Acoustica PLCU system was connected to control LO2 and fuel tanking per ETP-U-011.

Four Acoustica Control Units (P/N 50025219) for fuel tank probes were removed and replaced with Convair 7-04393-1 Control Units (Acoustica Model 810135, P/N 79404308).

TVA 91191, B change (7-89469) removes extension from engine LO2 tank line (29 July 1959).

TVA 91515 (7-89482) installs insulation on helium line between heater and helium ground disconnect (30 July 1959).

TVA 91517 (7-29232) installs insulation on all LO2 topping line swing valves (30 July 1959).

TVA 91516 (7-20220) installs insulation on LO2 "Y" duct and LO2 staging valve (30 July 1959).

GMA 5127 (7-86042) installs insulation on LO2 topping line from diesel LO2 subcooler to wall of transfer room (30 July 1959).

TVA 91508 (7-89482) removes orifice from LN2 exhaust port (30 July 1959).

TVA 91516B (7-20220) removes LO2 duct insulation aft of station 117, which is exterior of thrust structure (31 July 1959).

TVA 91519 (27-17524) installs measurement to determine back pressures in engine LO2 tank during initial fill (3 August 1959).

TVA 91521 (7-20227) increases size of engine LO2 tank overboard vent line to aid faster tank filling (4 August 1959).

TVA 91524 (27-17524) installs measurement for engine LO2 tank vent line pressure (4 August 1959).

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REPORT EM 1310

PAGE 50

TVA 91534 (27-17524) eliminates possible restriction in Engine LO2 Tank vent line (10 August 1959).

TVA 91530 (7-20227) installs orificed, overboard Engine LO2 Tank dump line with solenoid operated dump valve and provisions for flowmeter installation (11 August 1959).

TVA 91450B (7-20227) installed a one inch line from the main missile LO2 duct, between the B1 and B2 LO2 pump feed lines, to the Booster GG LO2 start line, between the Booster fill and check valve and the staging disconnect (14 August 1959).

TVA 91542 (7-20220) installed a scoop in the main missile LO2 duct to direct the flow of LO2 into the new engine LO2 tank fill line (14 August 1959).

Runs 428 and 429 were completed on 15 August 1959.

TVA 91516B (7-20220) installed insulation on the following LO2 ducting and valves: SK 19447-1 manifold, 7-23205-813 elbow assembly, 7-02230-9 valve, 7-02230-3 valve, and 27-02102-7 fill and drain valve. This same TVA also moved the following insulation for Run 431: from 7-23205-813 elbow assembly and from the portion of SK 19447-1 manifold which is inside the thrust section (18,19 August 1959).

TVA 91540C (7-20227) reroutes the new engine LO2 tank fill line to load LO2 through the Booster fill and check valve.

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REPORT RM 1310

PAGE 51

HISTORY OF PROBLEMS (RUNS 428, 429, 430, 431)

On 15 August during first attempt at Run 428 Emergency Pressurization had to be initiated when missile LO2 tank pressure rose to 10.7 PSIG. Discovered that valve L-26 was not opened prior to attempted run.

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PROCEDURE HISTORY (RUNS 428, 429, 430, 431)

<u>Date</u>	<u>Procedure Used</u>	<u>Objectives</u>	<u>Results</u>
14 August	ETP-P-044 Propulsion System Leak and Functional Check	Leak and functionally check 7-31-27 propulsion system.	Satisfactory
14 August	ETP-F-055 Fuel Tank Purge	Replace the GN2 content of the mis- sile fuel tank with helium.	Satisfactory
15 August	ETP-M-004 Precountdown (Re- issue 7/20/59)	Prepare for countdown, Run 428.	Satisfactory
18 August	ETP-P-044 Propulsion System Leak and Functional Check	Leak and functionally check 7-31-27 propulsion system.	Satisfactory
18 August	ETP-F-055 Fuel Tank Purge	Replace the GN2 content of the mis- sile fuel tank with helium.	Satisfactory
19 August	ETP-M-004 Precountdown (Re- issue 7/20/59)	Prepare for countdown, Run 430.	Satisfactory

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